NOVEMBER, 1961
50 Cents

Welding Engineer

Tubular design ... **p. 48**

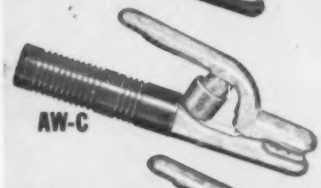
University Microfilms Inc
313 N First St
Ann Arbor Mich

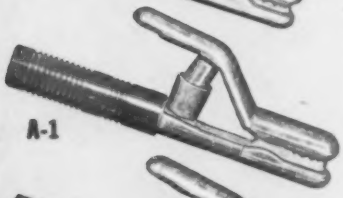
"Pick The Jackson Holder That Suits The Job!"

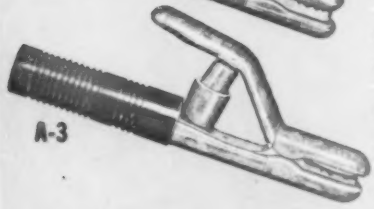
The *right* holder will speed the work, boost weld quality, and cut welder fatigue.

The right holder is one that's big enough to carry the required work load (determined by amperage, rod dia. and duty cycle), without burdening the welder with unneeded weight. The right holder for your work is one of the fourteen quality Jackson Holders listed below.

HIGH-PRODUCTION HOLDERS



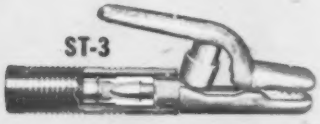




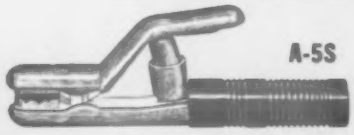
MAXIMUM CAPACITY AMPS	ROD	MODEL NO.	PRICE*	DESCRIPTION	
200	5/32"	JH-1	$4.50	High-Production Holders (See Duty Cycle Table)	COPPER ALLOY
300	7/32"	AW-C	6.50		
350	1/4"	A-1	7.15		
450	3/8"	A-3	8.90		
500	3/8"	A-3S	9.20		
300	1/4"	ST-3	7.90	As above, with Sealed-Tight Connection	
450	3/8"	ST-5	9.20		
300	1/4"	A-W	7.80	Featherlight Holders	ALUMINUM ALLOY
400	5/16"	A-5S	9.10		
200	5/32"	JH-2	7.50	Streamlined Featherlight Holders	
300	1/4"	JH-3	8.60		
300	1/4"	B-1	5.15	Economy Holders	98% COPPER
450	3/8"	B-3	6.65		
400	7/32"	B-4	5.00		

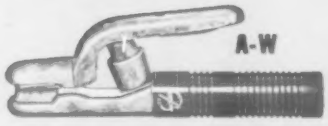
All Prices Lower in Quantities

SEALED TIGHT HOLDERS

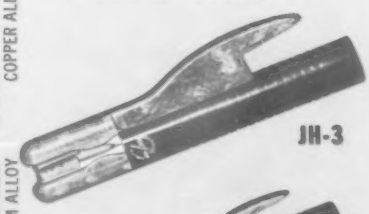


FEATHERLIGHT HOLDERS

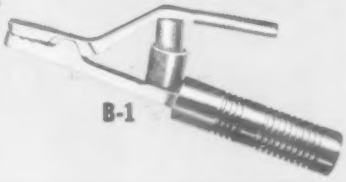




STREAMLINED HOLDERS



ECONOMY HOLDERS



HIGH-PRODUCTION HOLDER DUTY CYCLES

HOLDER CLASS	MODEL NUMBER	ELECTRODE DIAMETER	AMPERAGE	CABLE SIZE	DUTY CYCLE
SMALL	JH-1	5/32"	150 200	2 1	50%
MEDIUM	AW-C	7/32"	250 300	1 1/0	50%
	A-1 & ST-3	1/4"	300 350	1/0 2/0	50%
LARGE	A-3 & ST-5	3/8"	375 450	2/0 3/0	65%
EXTRA LARGE	A-3S	3/8"	500	4/0	80%

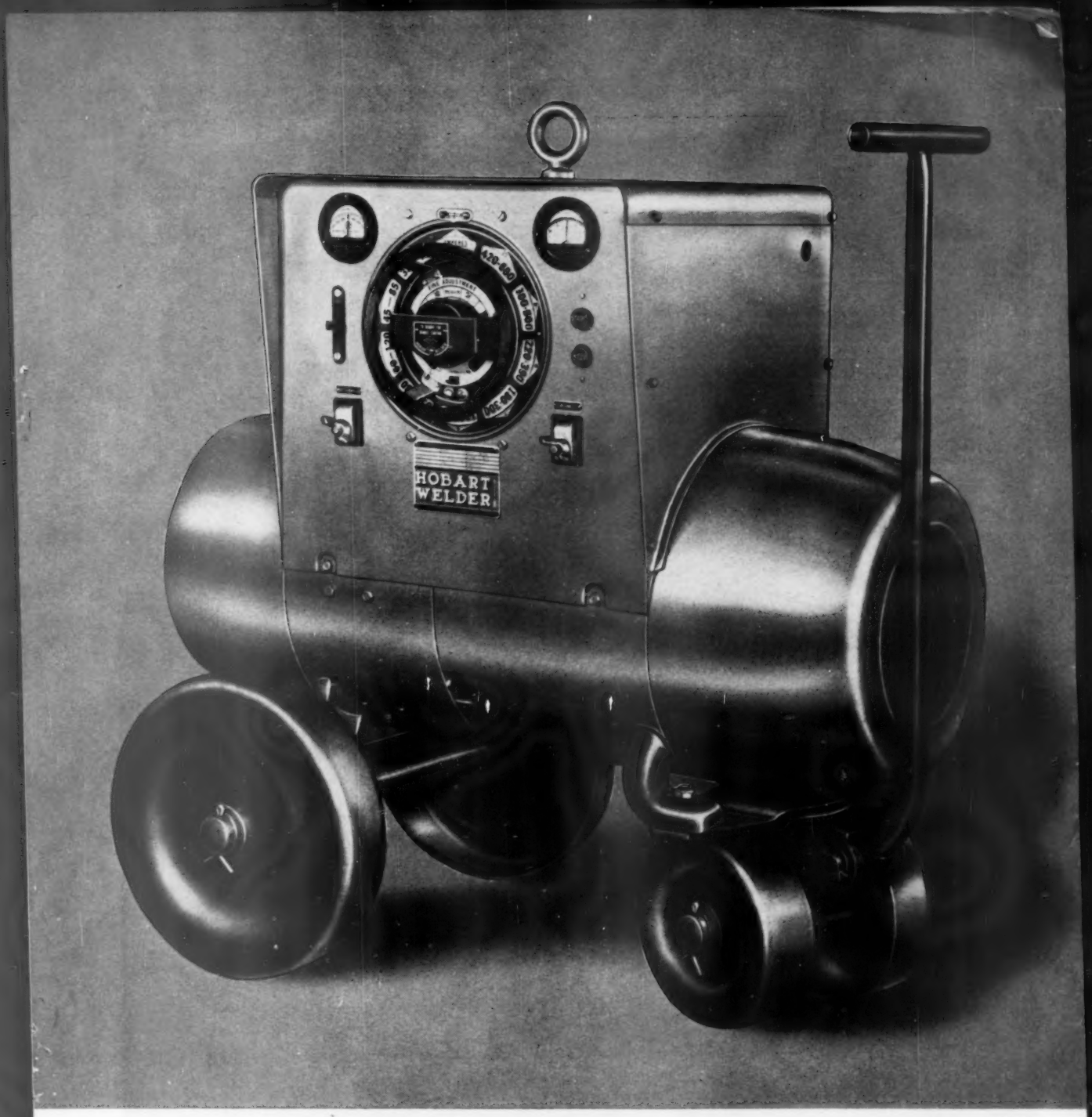
Sold Everywhere by Better Welding Supply Distributors

Jackson Products

AIR REDUCTION SALES CO., A DIVISION OF AIR REDUCTION CO., INC.

5523 Nine Mile Road, Warren, Michigan

For more facts Circle No. 150 on Welding Info-Aid Card



Model MP-304-P

Best selling Hobart welder gets a NEW LOOK

Why make changes in a best seller? To give you even more for your money! Notice the new visored canopy and the easy to read Multi Range Control. The new canopy adds more than style—it protects controls, meters, switches and terminals from damage. The new control switch is plainly marked—permitting operators to make up to 1,000 volt-amperage adjustments faster, more accurately. The popularity of Hobart Welders continues to grow year after year because of constant improvements in welder design and performance. Discover how a Hobart motor generator welder can profitably go to work for you. Write for bulletin DM-101 today.

HOBART WELDERS • ELECTRODES

Hobart Brothers Company Box U-111, Troy, Ohio, Phone FE 2-1223
Manufacturers of the world's most complete line of arc welding equipment
International Sales, Hobart Brothers A.G., Box 5500, Nassau, Bahamas

For more facts Circle No. 151 on Welding Info-Aid Card

Highland Tower Apartments, Pittsburgh, Pa.
Architect: Tasso Katselas
General Contractor: Navarro Corporation
Welding by Crawford Steel Construction Co., Inc.
Welding Distributor: Weaver Welding Supply Co.

Jack Crawford (partner in the Crawford Steel Construction Co.) supervised steel erection

This modern 22-story apartment building was welded with Hobart "Rocket 24" and No. 10 electrodes. "Rocket 24" practically doubles the deposition rate of the ordinary E-6012 mild steel electrode. Hobart No. 10 makes welding easy on vertical and overhead welds due to the low spatter and excellent penetration. Try Hobart electrodes—approved and dependable for hi-speed, cost cutting welding operations.

Hobart Brothers Company, Box U-1111, Troy, Ohio

This is welding: November, 1961

Welding Engineer

The magazine of joining and severing of materials

Cover photos . . . tetrahedral-shaped spires for Air Force Academy utilize tubular design . . . rail steel flats, angles, etc., used in farm and earthmoving equipment

Tubing uses grow due to appearance and strength 42
The primary reason for tubing's growing popularity is its favorable strength-to-weight ratio, and with increased acceptance, higher production and reduced costs result. **Rex Cleveland** describes the design principles of using welded tubing in its various shapes.
★ (For a reprint of this article, circle number 248 on Welding Info-Aid Card.)

Impact-spot method can reduce machine weight 46
Since a resistance spot welder's cantilever arms must also act as a press, arm weight and mass can be a problem. But researchers at Armour Research Foundation may have found a solution in their experiments using a dropped weight to provide electrode forging force.

Rail steel can be welded easily 48
Double tensile strength, high hardness, yet priced comparable to the low-carbon steels — these are rail steel's advantages. But can it be welded successfully? Yes, say authors **Norman R. Braton** and **Donald Roeber,** who conducted weldability tests at the University of Wisconsin.
★ (For a reprint of this article, circle number 249 on Welding Info-Aid Card.)

Upside-down Tig welding maintains uniform pipe contour 52
Overhead welding is usually avoided, but this Wisconsin firm Tig welds tubing seams upside-down. The patented process lets gravity do the work of forming the inner weld contour to the pipe's wall contour, as reported by Editor **F. T. Tancula.**

How to weld austenitic stainless steel 66
Next to the plain carbon steels, the austenitic stainless steels are probably the most commonly welded metals. Any of the arc, gas or resistance welding processes can be used — provided proper precautions are taken, as detailed by **Simon A. Greenberg.**
★ (For a reprint of this article, circle number 250 on Welding Info-Aid Card.)

Also in this issue:

Super vacuum causes metal evaporation, cold welding 41
Metals, welding techniques covered at AWS meeting 56
Nb-steel pipe offers weldability, strength, economy 58
Tig welded copper pipe provides heating, ventilation 62
Space tower's welds get X-ray inspection 74

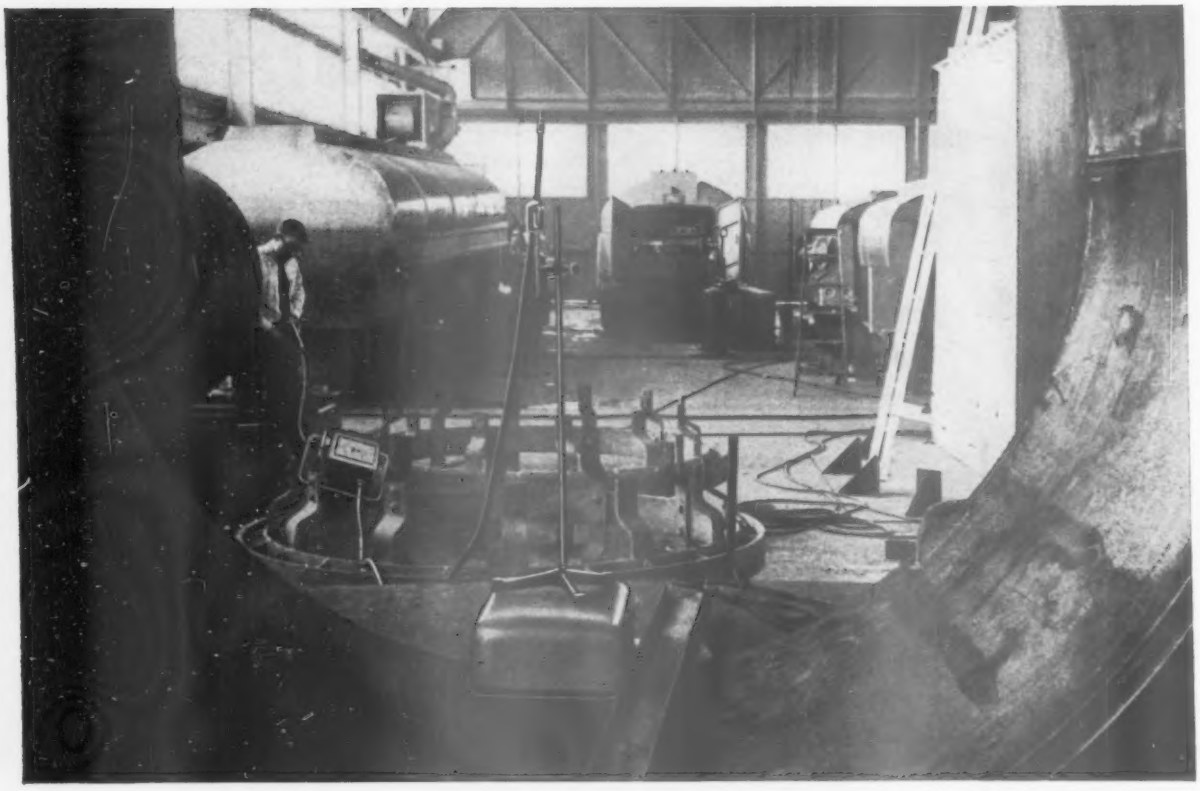
VOL. 46—No. 11

Regular **WE** features . . .

November Headlines 7
Letters 10
Your WeldWorld at press time 15
Dateline: Washington 16
Between passes 25
New products for you 26
Editorial: A degree of discontent 39
Data Sheet No. 255 — Fillet weld stresses 79
VIPs in review 81
In retrospect 84
The Welding Shopper 85
Literature for your library 86
Welding Info-Aid Card 87
Advertisers' literature 87
Advertisers in this issue 88

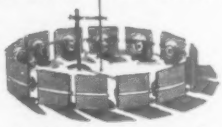
WELDING ENGINEER is published monthly with an additional directory number in June by Welding Engineer Publications, Inc. Publication office: 600 S. Seventh St., Rochelle, Ill. ©1961 by Welding Engineer Publications, Inc. Executive, editorial and advertising offices: 5826 Dempster St., Morton Grove, Ill. Circulation office: 4050 N. Milwaukee Ave., Chicago 41, Ill. Controlled circulation postage paid at Rochelle, Ill. and Morton Grove, Ill. Subscriptions: U. S. and possessions, $3 per year.

Postmaster: Please send form 3579 to Welding Engineer, 5826 Dempster St., Morton Grove, Ill.



"one-shot" radiography of this 24 foot steel girth weld

... or group inspection | of small parts



it's all in the day's work for a Tech/Ops unit

In the broad *Tech/Ops* line there's probably a gamma radiography unit that's precisely right for your inspection job. Iridium^{192} units (10 to 100 curies) for handling steel 3/8" thick and up, or light metals over 2". Cobalt^{60} units (3 to 100 curies) for steel, brass, copper, superalloys up to 6".

All of them are completely self-contained: everything needed for the job goes right along to it. Range in size and weight from a 58 lb. suitcase (*Little David*) to easy-rolling wagons (*Goliath*). They're simple to run, safe to use, rugged and dependable. The radiographs they turn out (with properly chosen techniques) are equal in every way to those made with x-rays — and so recognized by MIL codes.

Tech/Ops Radiography Units cost little to buy (or rent, if you like). Matter of fact, over 80% of today's isotope radiography is being done with units costing less than $3,000.

To find out where these versatile inspection workhorses may fit into your scheme of things, call any local Picker office (see 'phone book) or write Picker X-Ray Corporation, 25 So. Broadway, White Plains, New York.

Picker x-ray

WELDING ENGINEER

America's pioneer publication which, combined with The Acetylene Journal, has been devoted to the interests of welding and its allied industries since 1898.

WELDING ENGINEER PUBLICATIONS, INC.
P.O. Box 28
Morton Grove, Ill.
Telephones:
YOrktown 5-5130, IRving 8-3355

TED B. JEFFERSON
Publisher

FELIX T. TANCULA
Editor

G. J. CANNIZZO
Managing Editor

STUART KAMINSKY
Associate Editor

DON JEFFERSON
Art Director

JACK FAIRLIE
Special Projects

REX CLEVELAND
Contributing Editor

ROBERT M. DAVIS
Production

LLOYD GOSSMAN
Circulation
JIM BREWSTER
Circulation Promotion

HERMAN C. PHELPS
Vice President
Eastern District Manager
P.O. Box 128, White Plains, N. Y.
Telephone: WHite Plains 9-3876

JACK FLYNN
Midwest District Manager
P.O. Box 28
Morton Grove, Ill.
Telephones:
YOrktown 5-5130, IRving 8-3355

MEMBER
AMERICAN WELDING SOCIETY
INTERNATIONAL ACETYLENE ASSOCIATION
COMPRESSED GAS ASSOCIATION
NATIONAL WELDING SUPPLY ASSOCIATION
BUSINESS PUBLICATIONS
AUDIIT OF CIRCULATION

Single copies 50 cents. Subscription rates: United States and possessions $3 per year; $5 for two years; $7 for three years. Canada $5 per year; $8 for two years; $10 for three years. All other countries $15 per year; $25 for two years; $30 for three years. Position and company affiliation must be indicated on subscription form. Allow one month for change of address.

WELDING ENGINEER is indexed regularly by Engineering Index, Inc.

SAVE...
20% of your total electrode cost!

You can eliminate costly electrode stub losses by using "*Shortstub*" Electrode Holders. "*Shortstub's*" unique design with downward extending jaws allows the deposit of the total flux portion of the electrode, saving you 15% to 20% of your total electrode cost.

Write today for bulletin SS7, describing the *MANY cost-saving features of "Shortstub"!*

Shortstub Electrode Holders
—proved in thousands of plants daily.

PIONEER FOR
BERNARD
MODERN WELDING

"Shortstub" electrode holders
"BERNARD" hammer-on cable connectors
"MULTI-PIC" slag chipping hammers
"LC" high current welding apparatus
"BERNARD" welding equipment coolers

BERNARD WELDING EQUIPMENT CO.
10232 Avenue N, Dept. WE, Chicago 17, Illinois

Only Norton brings you these new time-savers!

Dis-Card mounts cut portable wheel changing time from minutes to seconds!

Type BSA, new Cut-N-Saucer shape with new Dis-Card mount.

Type BD, straight, with knurled sides and new Dis-Card mount.

Type BDA, straight, with new Dis-Card mount.

Now you can mount three types of Norton reinforced wheels — BSA, BD and BDA — on portable grinders without a single wrestling match!

As on the new Type BSA Cut-N-Saucer wheels, Norton now adds Dis-Card mounts to Types BD and BDA — long the most popular wheels for blending, cleaning and other everyday welding-shop jobs.

The new Dis-Card mount is a big improvement over ordinary mounts. It's attached to each wheel, *permanently*. Which means you can change wheels in seconds — because there's no "lock washer" action. Every Norton wheel with a Dis-Card mount is already mounted — and *stays* mounted until you throw both wheel and mount away.

Yet you pay no more for Norton reinforced wheels with Dis-Card mounts than for ordinary wheels.

Final cost is less, in fact, because these wheels are engineered to last longer, cut faster and do more work. And don't forget that Cut-N-Saucer wheels have another advantage. They can be held at angles much closer to the horizontal, for easier control and less operator-fatigue.

For further facts on these new time-and-money saving wheels, see your Norton Distributor, or write to NORTON COMPANY, General Offices, Worcester 6, Mass. Plants and distributors around the world.

NORTON
ABRASIVES

W-2031

Making better products . . . to make your products better

NORTON PRODUCTS: Abrasives • Grinding Wheels • Machine Tools • Refractories • Non-Slip Floors — BEHR-MANNING DIVISION: Coated Abrasives • Sharpening Stones • Pressure-Sensitive Tapes

November Headlines

DESTRUCTIVE testing of a welded structural shape takes place in the mechanics laboratory of the recently-dedicated Homer Research Laboratories of Bethlehem Steel Co.

Bethlehem Steel Co. dedicates $25 million research laboratory

The $25 million mountain-top Homer Research Laboratories of Bethlehem Steel Co. have been formally dedicated.

Located in Bethlehem, Pa., the facilities employ over 450 people and cover 75 acres on a 1,000-acre site.

Research equipment at the laboratories includes a full range of manual arc and gas welding equipment, flash welders, a spot welder and console-controlled submerged arc units mounted on ram-type fixtures.

Mechanical testing equipment includes a 100,000-lb universal tester, two 10,000-lb tensile machines, a 30-ton drawing press, an impact machine and a high-speed rotating beam fatigue machine.

A complete spectrographic laboratory, electron testing facilities, structural testing equipment and a process metallurgy plant are among the other facilities now in use.

Under construction is an electro-mechanical building and a mechancial engineering building.

Army invites bids to build containers

The Army Transportation Materiel Command, St. Louis, has issued invitations to bid on a partial contract for two different sizes of welded Conex steel cargo containers. (See WELDING ENGINEER, January, 1961, page 48.)

Bids are due around November 15. The estimated contract award date is December 15.

West Germany is good potential market

West Germany has a high market potential for U. S. welding and cutting exports.

This conclusion is based on reports made by two American companies exhibiting at the recent welding and cutting fair in Essen, Germany, and on the number of inquiries received by the American Consul General in Duesseldorf.

One of the firms, Hobart Bros. Co., Troy, Ohio, sold a substantial amount of equipment it displayed and has made plans for wider distribution in West Germany.

The other, Aluminum Co. of America, Pittsburgh, had a successful display and indicated that negotiations are pending concerning a licensing arrangement with a West German firm.

Many Germans who contacted the Consul General voiced interest in new techniques and processes and claimed that the United States is ahead of the Europeans in such equipment.

According to a consulate report received in Washington, D. C., Hobart, which has been doing considerable business in other Western European countries, had purposely shied away from the West German market because of expected intense competition.

Hobart's experience at the fair showed that their products are competitively priced with German goods, and the Germans are willing to buy.

WELDING ENGINEER was told by a Dept. of Commerce offical that the U. .S consulate in Duesseldorf "was flooded with inquiries as a result of the U. S. exhibits."

According to the Consul General: "The Department might wish to secure literature and prices on the newest types of welding and cutting equipment from United States manufacturers interested in foreign sales, which we shall be pleased to forward to a number of trade associations having expressed an interest in . . . such information."

Interested manufacturers can contact the American Consul General, Duesseldorf, Germany.

NYU to hold 2-day beryllium conference

New York University's College of Engineering will sponsor a 2-day conference on beryllium metallurgy on Dec. 4-5.

Welding, brazing, structural applications and metallurgy will be stressed.

For further information, contact Mel Berk, College of Engineering, New York University, New York 53, N.Y.

Canadian Welding Bureau offers weldor's course

The Canadian Welding Bureau is offering a home study course for weldors.

The course, covering basic theories and fundamentals, is not designed to teach the student to weld, but to teach a weldor more about his job.

Details can be obtained from the bureau which is located at 1393 Yonge St., Toronto 7, Ontario, Canada.

Airco constructs gas facilities on 2 continents

Various divisions of Air Reduction Co., Inc., New York City, are building industrial gas facilities from Ohio to Santiago, Chile.

Air Reduction Sales Co. has signed an agreement to furnish oxygen from a tonnage plant to E. I. duPont de Nemours & Co. The plant will be built by Airco on a site adjacent to DuPont's new methanol facility under construction near Huron, Ohio.

Air Reduction Pacific Co. has completed a ¼-million-dollar helium compressing plant in Portland, Ore., and is expanding its air separation plant in Richmond, Calif.

In addition, Airco Co. International will supply two oxygen plants and an acetylene-generating facility to Industria Chilena de Soldaduras, S.A., Santiago, Chile.

Governor cuts chain

GOVERNOR Wallace Barron of West Virginia, with the aid of William A. Rice (right), president of Virginia Welding Supply Co., cuts the chain officially opening the second biennial West Virginia Mining and Industrial Show held recently. Rice was show chairman.

$1,000 galvanizer awards presented

Two $1,000 international awards have been presented by the American Hot Dip Galvanizers Association in cooperation with the American Zinc Institute.

Earl H. Lenz of Buffalo Forge Co., Buffalo, N.Y., received one award for a spot welding method of making housings. Ralph D. Barer, consulting engineer, Victoria, B.C., received the award for his idea of using forged and galvanized steel clamps for scaffold construction.

Chapman heads Detroit copper-mill office

In a move to accelerate their technical liaison with the auto industry, makers of wrought copper-metal mill products have named Richard D. Chapman to head the Detroit office of the Copper & Brass Research Association.

Chapman took the job after 25 years with Chrysler Corp.

Copper & Brass awards competition opens

Anyone associated with the use of copper, brass or bronze has been invited to enter the 1962 Copper and Brass Achievement Awards Competition sponsored by the Copper & Brass Research Association.

The contest is designed to honor outstanding new developments in the use or application of the copper metals in the United States. First prize awards will be $500 and trophies.

More information is available from the Association at 420 Lexington Ave., New York 17, N.Y.

Refresher course

LAST refresher course of the summer at Hobart Bros. Technical School includes this Tig welding demonstration. Seventy-five industrial arts and vocational agriculture high school teachers attended the 1-week courses held throughout the summer.

NEMA to hold 35th annual meeting

The National Electrical Manufacturers Association will hold its 35th annual meeting on Nov. 16 at The Plaza Hotel, New York City.

More than 300 representatives of the association's 500-plus members are expected to attend the opening meeting at which five top electrical industry executives will review progress made during the year and highlight plans for the future.

(More news on page 72)

COMING EVENTS

NOV. 7-9: 8th Industrial Electric Exposition, Electric League of Western Pennsylvania, Penn-Sheraton Hotel, Pittsburgh.

NOV. 16: 35th Annual Meeting, National Electrical Manufacturers Association, The Plaza Hotel, New York City.

NOV. 16-17: Engineering Institute on Welding of Structural Members, University of Wisconsin, Madison, Wis.

NOV. 27-28: NWSA Southeastern Zone Meetings, Atlanta Biltmore, Atlanta.

NOV. 30-DEC. 1: NWSA Southwestern Zone Meeting, Sheraton-Dallas, Dallas.

DEC. 4-6: Winter Meeting, Independent Oxygen Manufacturers Association, Alffer Hotel, Mexico City.

JAN. 22-25, 1962: National Plant Engineering & Maintenance Show, Convention Hall, Philadelphia.

JAN. 29-Feb. 2, 1962: Winter General Meeting, American Institute of Electrical Engineers, New York Coliseum, New York City.

A *Fast Cut* To SAVE MONEY!

NEW MANHATTAN *Fast Cut* MOLDISC

DEPRESSED CENTER TYPE 27

- will remove more metal—
- grind more welds—
- get *more* work done *faster* than any other wheel of its type

STANDARD STOCK SIZES SPECIFICATION A24-Q8-BR							
DIA.	7"	7"	7"	DIA.	9"	9"	9"
THK.	1/8"	3/16"	1/4"	THK.	1/8"	3/16"	1/4"
HOLE	7/8"	7/8"	7/8"	HOLE	7/8"	7/8"	7/8"

Try The New MANHATTAN *FAST CUT* MOLDISC—

and *SAVE MONEY* on Your Next Job!

RM-1068

ENGINEERED RUBBER PRODUCTS . . . MORE USE PER DOLLAR

RM

WRITE TO ABRASIVE WHEEL DEPARTMENT

MANHATTAN RUBBER DIVISION • PASSAIC, NEW JERSEY

RAYBESTOS-MANHATTAN, INC.

REPAIR and REBUILD
WORN BUCKET PARTS
THIS ECONOMICAL WAY

● Manganal has the greatest toughness, with work-hardened abrasion resistance, of any steel. Protects profits by keeping equipment producing longer . . . with less cost than new parts.

WORN HEAVY-DUTY EQUIPMENT PARTS REQUIRE . . .
HEAVY-DUTY
MANGANAL®
11¾-13½% MANGANESE-NICKEL STEEL
ABSORBS IMPACT AND ABRASIVE WEAR LONGER THAN NEW PARTS

BUCKET DOOR-flame cut from Manganal Hot Rolled Plate.
BUCKET DOOR LATCH PIN — cut from Manganal Square Bar.
BUCKET DOOR LATCH PIN BRACKETS — form from Manganal Flat Bars.
BUCKET SIDES — cut from Manganal Flat Bars.
BUCKET CUTTING EDGE FOR WORN LIP — bend from Manganal Hot Rolled Wedge Bar.
BUCKET TOOTH SOCKETS—reinforce with Manganal Round Bars.
BUCKET CUTTING EDGES BETWEEN TEETH — cut from Manganal Hot Rolled Wedge Bars.
BUCKET FLOOR LINER — flame cut and bend from Manganal Hot Rolled Plate.
BUCKET HITCH PINS & HINGE PINS — cut from Manganal Round Bars.
CRACKED BUCKET LIP—repair with Manganal Electrodes for extra strength.
BUCKET HEEL — reinforce with Manganal Flat Bars.
BUCKET TAPERED LIP—form from various thicknesses of Manganal Round Bars.
BUCKET TEETH — repoint with Manganal Wedge Bars.

Available from all welding distributors.
Nearest Distributor Upon Request. Send for Helpful Literature.
STULZ-SICKLES CO.
929 Julia Street • Elizabeth, New Jersey

Letters

Welch deserves it

On past occasions I have written you and complimented you on certain editorials and/or articles in some of your recent issues of WELDING ENGINEER.

The article in "Between Passes" on Jerry Welch is a most factual and humane resume of this wonderful man's career.

I have known Jerry for the past 11 years and I consider his friendship one of my closest formed through the American Welding Society. Congratulations for devoting a full page to such a fine man in your wonderful magazine.

J. W. Kehoe
Metals Joining Section Manager
Westinghouse Electric Corp.
East Pittsburgh, Pa.

Old timers

I receive WELDING ENGINEER each month and enjoy it very much. I have a grandfather who is 100 years old and who was a blacksmith and weldor all of his life and retired when he was about 86 years old. Now I often wonder if some of the processes I read about in WE might have been done by him first.

About 50 years ago my grandfather went to Detroit auto plants to show them how to weld cast iron . . .

When I used to work in his shop, he made his own rods for gas welding. He had a shop in Atlantic City for years where most of his sons and grandsons learned to weld.

R. Schoenleber
Pleasantville, N.J.

I am now 67 and have been welding for over 46 years.

I grew up in the trade starting in the winter of 1914 and I have spent my time in industrial welding exclusively working on tail shafts, rudders of large ships, diesel blocks, shovels, marine equipment of all kinds. Name the job and I have probably done it.

In France during World War I,

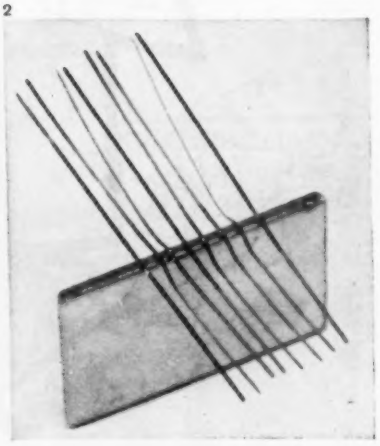
"Impossible" welds

Welds that are impossible by any other technique are now routine with Hamilton-Zeiss' high-energy density electron-beam welding. Hamilton-Zeiss equipment offers you unique performance combined with flexibility, reliability and repeatability / Difficult materials, unequal dimensions and deep penetrations present problems that only Hamilton-Zeiss welding equipment can solve with its high-energy density and precision electron-beam focusing by the exclusive Zeiss magnetic lens system. The Hamilton-Zeiss weld, created in a vacuum, offers these significant advantages: virtual elimination of contamination, close control of penetration, low thermal distortion and close dimensional control. Exhaustive tests demonstrate conclusively that welds produced by the Hamilton-Zeiss method are as strong as the original materials. Supporting metallurgical data are available for your inspection / For full information call Hamilton-Electrona, Inc., exclusive marketing agent for Hamilton-Zeiss equipment in the United States and Canada.

1

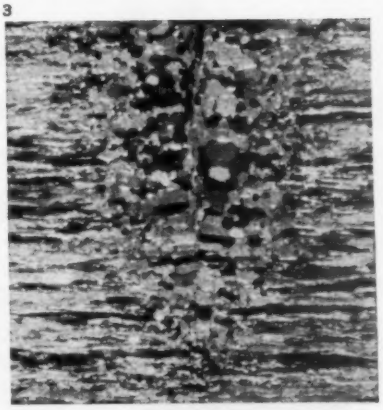
1 / Penetration study of one-inch thick Type 302 stainless steel reveals an amazing depth-to-width ratio. High-energy density and sharp focusing produce this unique weld with no reduction in the original strength of the material.

2



2 / Copper ribbon wires (0.002" x 0.010") welded to the edge of a nickel-plated ceramic substrate. This is just one demonstration of the ability of Hamilton-Zeiss equipment to weld dissimilar materials. Because of the unique design of the Hamilton-Zeiss equipment, electrons travel at approximately 110,000 miles/second to the work piece.

3



3 / Study of weld on 0.100" tungsten shows minimum grain growth and no evidence of contamination. The high-energy density beam minimizes grain growth because welding time is extremely short and heat is applied to an exceptionally small zone. Contaminants are eliminated by welding in a high vacuum without filler; impurities are outgassed during the cycle.

HIGH-ENERGY DENSITY ELECTRON-BEAM WELDING BY HAMILTON-ELECTRONA, INC.

TIME-LIFE BUILDING, ROCKEFELLER CENTER
NEW YORK 20, N.Y / PHONE PLAZA 7-9548-9

For more facts Circle No. 158 on Welding Info-Aid Card

I was the only weldor at three large shops who received WELDING ENGINEER. My brother-in-law was kind enough to see that I received copies while I served in France.

Over the years I have gained much from your publication—the new developments have been especially interesting.

I wish you the best of success in future years and good luck.

R. R. Christensen
Portland, Ore.

Cleveland challenged

The article in the September WELDING ENGINEER by Rex Cleveland has some interesting observations on use and combinations of structural sections but introduces the observations with some unusual statements.

The one most confusing occurs on page 45 under the subheading, "The Principal Limitations" and is as follows: "No steel member is stronger than the modulus of elasticity for steel (30,000,000 psi in tension; 11,600,000 psi in torsion) regardless of type or analysis." Since the modulus of elasticity is a factor comprised of the ratio of unit stress to unit strain at stresses below the elastic limit, it should not be expressed in pounds per square inch and its relationship to the strength of a member without consideration for the strength of the material in the member seems a fallacy.

Can you ask Mr. Cleveland for an explanation of the statement and provide some clarification of what seems to be misleading?

W. H. Jacobs
Executive Secretary
Rail Steel Bar Association
Chicago

— Mr. Jacobs is quite right, but nearly everyone uses "psi" with modulus of elasticity figures. For instance: Jones & Laughlin Steel Corp. in their recently-issued pamphlet on "Cor-Ten" (May, 1961) and the ASM Metals Handbook in their listing of "Some properties of the elements" (1948 ed., p. 21).

As to your objection of its use (30,000,000) without reference to strength of material, you will find by investigation there is so little difference — analysis — as to be negligible. The 30,000,000 is simply a round figure used to express the M. of E. of all steels. — Rex Cleveland.

Looking for a resistance-welding electrode not easily beat by
sustained heat?

Order AMPCO-WELD® for your high-temperature applications.

Send for catalog, price list, and name of your distributor.

AMPCO®

AMPCO METAL, INC., DEPT. 187K, MILWAUKEE 1, WISCONSIN
West Coast Div.: Huntington Park, Cal.
Southwest Div.: Garland (Dallas County), Texas

RW-25

BRIDGEPORT WELDING ROD

helps build things....

things like today's modern stoves and refrigerators to brighten milady's kitchen. Whatever your application, in building or maintenance, look for a rod stamped "Bridgeport." Because of laboratory-controlled manufacturing, Bridgeport welding rods can be relied upon for uniform quality...dependable performance. Every alloy tins easily...flows freely... produces dense, sound, non-porous welds of uniformly high strength and ductility. They're available in standard rod sizes and lengths, and coils or spools for automatic equipment. Call your local distributor.

Get your free copy of Bridgeport's "Bronze Welding," write:
BRIDGEPORT BRASS COMPANY, Bridgeport 2, Connecticut

Bridgeport Brass Co.

BRIDGEPORT BRASS COMPANY

Specialists in Metals from Aluminum to Zirconium

Why shout?

We don't make fancy claims, just good electrodes. We take great care in making them. We make all kinds, too.

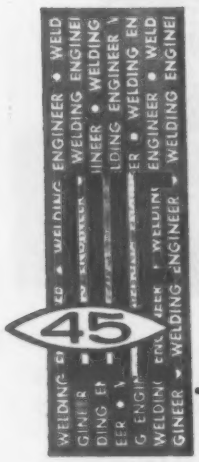
All we ask is that you try a box. We think you'll be pleased with the way they weld. BUT: If they aren't — in your honest opinion — as good or better than any electrode you've used, bring back the box and we'll give you back your money.

Square deal?

HARNISCHFEGER

Milwaukee 46, Wisconsin

P&H WELDING PRODUCTS DIVISION



Your November, 1961

Weld World

As WE went to press, these were the industry's latest developments:

. . Another manufacturer has entered the welding-alloy field. National Standard Co., Niles, Mich., is now producing welding wire and will market it through regional distributors. First wires offered: stainless types 308, 309, 310, 316 and 347.

. . Metal & Thermit Corp., New York City, and The Udylite Corp., Detroit, will merge upon approval of stockholders of both firms. The latter makes metal-finishing equipment. It would continue under present management as a division of Metal & Thermit.

. . Aluminum producers have cut their ingot prices about 2 cents per pound, citing continual undercutting by European sources over recent years. This increases pressure on steelmakers to keep their prices at present levels. Adding to the pressure: the expected increase in steel orders (at this writing) has failed to materialize.

. . Harnischfeger Corp., Milwaukee, has sold its welding positioner business to Pesco, Inc., Pittsburgh. The positioners will be marketed under the name "Pesco-P&H" and will continue to be sold through Harnischfeger's Welding Products Div., as well as through additional sales outlets to be determined by Pesco.

. . Riegel Textile Corp. is no longer in the industrial glove business. Its glove inventory has been sold to Boss Mfg. Co., Kewanee, Ill., which has also leased the Riegel Plant at Greenville, Ala.

. . The ultrasonic, X-ray and magnetic particle lines of Sperry Products, Danbury, Conn., have been sold by Howe Sound Co. to Automation Industries, Torrance, Calif. Sperry will operate as a division and will continue operations in Danbury.

. . At least one manufacturer of arc welding accessories has announced a "small increase in prices on some models," effective Nov. 1.

dateline: WASHINGTON

There is going to be another delay in the economy's full recovery – and the culprit this time is the consumer. For almost eight months now the recovery has been in effect; income is up 4% over February; outstanding credit has dropped 2% from the December, 1960, high; savings accounts are bulging.

Yet consumer spending (the one economic indicator in which a majority of businessmen put great store) has been lagging. The Commerce Department announced that September retail sales dropped one-quarter of 1% from August to a little more than $18.1 billion.

This makes the experts jumpy since the U. S. public accounts for two-thirds of all spending, and has only to spend an extra 3½% to produce the same economic boost as a 15% increase in business spending or 21% in government outlays.

The consumer's dollar encourages industry to keep adding to its inventory after the initial surge (which starts the recovery) begins to fade. Thus, if the consumer does not buy the extra end products produced, the recovery begins to run down. However, the full boom is still on the way, according to the economic experts; it may take until December or possibly even January.

* * *

Treasury Secretary Douglas Dillon called for a speed up in depreciation of industrial equipment. Addressing the annual convention of the American Bankers Association in San Francisco, he stated that all industrial countries of Western Europe, except Belgium and the United Kingdom, are devoting twice as much of their gross national product to purchases of industrial equipment as the U. S.

But any depreciation reform is likely to be delayed, according to authoritative sources, until the 8% across-the-board credit bill is either passed or permanently killed in the next Congressional session.

Dillon also called for an updating of Internal Revenue Service calculations of depreciable lives so they would reflect conditions "in this age of rapid technological change."

* * *

How much higher are U. S. production costs than those of plants abroad? The National Industrial Conference Board studied 100 companies with plants both here and overseas. Conclusions: foreign producers do have lower costs on many items – but not on all, by any means. (For more on foreign competition see p. 7)

In fact U. S. industry had lower unit costs on slightly more than half the items compared. Labor costs us more; materials cost less. We produce more cheaply, overall, than Canada (by 10%), Australia (16%) and Latin America (up to 25% total). Production costs are lower, however, in Europe's Common Market by 3%.

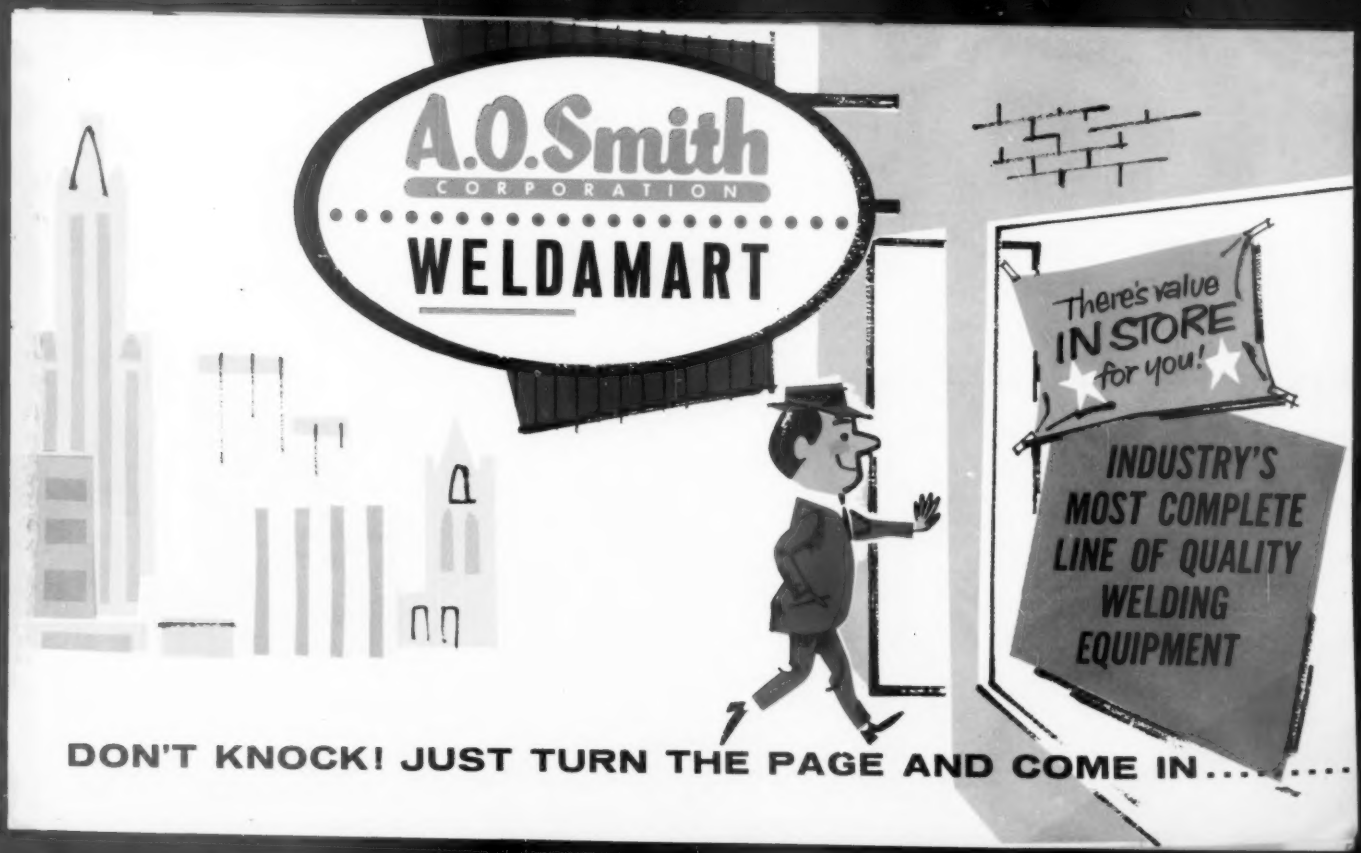
* * *

Businessmen who make or furnish items for the government must pay all employees who work on the items the particular minimum wage or higher as determined under the Walsh-Healey Act.

The act sets up minimum wages for federal government contracts of $10,000 or more for materials, supplies, articles and equipment. The minimum is set by the Secretary of Labor after hearings and varies from industry to industry (e.g., from $1.15 to $2.85 an hour). Most of the wages are national; however, some are regional.

Single copies of the new list of minimum wages are available free from the U. S. Chamber of Commerce, Washington 6, D. C.

For more facts Circle No. 161 on Welding Info-Aid Card →


A.O.Smith
CORPORATION
WELDAMART
There's value IN STORE for you!
INDUSTRY'S MOST COMPLETE LINE OF QUALITY WELDING EQUIPMENT
DON'T KNOCK! JUST TURN THE PAGE AND COME IN.....

Shopping for WELDING EQUIPMENT?
HERE'S ONE-STOP SERVICE
FOR ALL YOUR NEEDS
OVER 70 DIFFERENT TYPES OF ELECTRODES
We make all kinds! Mild steel...iron powder ... low hydrogen ... stainless steel ... cast iron ... low alloy-high tensile. Also stainless, hard facing and automatic wires to meet every welding need.
VALUE
FREE SAMPLE
New A. O. Smith SW610 out-performs any electrode in the E6010 class. Send for free sample or get in touch with the A. O. Smith representative or distributor near you.

YOUR WELCOME TO BROWSE
AISLE 1
Semi-automatic & automatic welding equipment
High-speed automatic package that's easy to set up, easy to use. For all types and sizes of consumable electrode wire used for automatic welding, gas-shielded processes.
Complete packages to suit any semi-automatic welding needs. Choice of four power sources, three wire drive units and four hand guns. Also special Button Weld timer for light-gauge arc spot production welding.
COMPLETE PACKAGE

Proven the Nations Top A.C. Welder
on the nation's top production lines
AISLE 2
A.C. production welding machines
STACK 'EM RACK 'EM SLIDE 'EM UNDER A BENCH
A.C. Extra-Heavy-Duty — Built to exacting standards for those who want the finest in production welding equipment. All it takes for smooth, efficient operation and many extra years of machine life. Available in 300, 400 and 500-amp models.
A.C. Auto-Man — Buy 'em singly or in series, for manual or automatic welding. Just the thing for the shop that doesn't want to tie up a lot of cash in automatic equipment.
The All-New MONARC MARK II
king of the low-cost welders
You get all this: Famous moving coil design . . . easy adjustment . . . full 80-volts open circuit voltage . . . full current output in a single range . . . space-saving, low-boy design . . . easy "add-on" accessories including D.C. conversion. This versatile machine is available in 300, 400 and 500-amp models.
A.O.Smith
A.C. WELDER

GUARANTEE
All A. O. Smith welding machines are guaranteed to provide for free replacement of any part that fails due to defective workmanship or material within one year from date of purchase.
AISLE 3
D.C. welding equipment
MORE SPECIALS...
D.C. POWER SOURCES — Saturable reactor or moving coil design for use in sub-arc and other automatic processes, arc air cutting and gouging, plasma jet systems, etc.(Customized models available.)
D.C. CONVERTERS — 250 and 450-ampere units convert any A.C. welder in your shop into a D.C. rectifier. Full 60% duty cycle. They're compact, easily portable, safe and simple to set up.
DUAL-DUTY
MODEL A6500AD A.C./D.C. WELDER — For A.C. and heavy iron powder electrodes or on D.C. manual submerged-arc units. An extremely wide current range allows you to use it with any size electrode. Optional built-in circuits enable it to be used with manual submerged-arc units.
A.O.Smith POWER
800, 1000, 1250 amp
200, 300 400 amp output
SUPER SILICON RECTIFIER — You work with the exact arc characteristics you need at your fingertips: Forcing arc for heavy arc penetration . . . smooth arc for light sheet . . . arc booster for hard to start electrodes. (Also available with selenium rectifiers.)
A.O.Smith AC-DC WELDER

AISLE 4
gas drives and multiple-operator units
Here's the ultimate in dependable power for A.C. or D.C. inert arc welding offering handy, easy setting and control. All models (200, 300, 500 amp) are high-frequency units with gas, spot gun controls as accessory equipment.
2 AND 4 WHEEL TRAILERS AVAILABLE
BUG
LIQUID-COOLED
FOR INERT GAS WELDING
FOR SPOT GUN
FOR METALLIC ARC WELDING
A.O. Smith
AC-DC ARC WELDER
You can really go places with A.O. Smith D.C. gas drives. They're both air- and liquid-cooled featuring optional electric start, meters, dual arc reactors. All have simplifed controls to speed the job . . . extreme arc stability . . . longer unit life and reduced operating costs. Choose from air-cooled 200 amp "Bug" and three liquid-cooled models (200, 300, 400 amp).

Multi-Operator Welding Systems
D.C. CONSTANT POTENTIAL MACHINES—Using standard resistance grids, many users report up to 30 welders working from one power source. They're designed to augment or replace cumbersome and troublesome motor generators as well as for new applications. Available in 500, 750 or 1500 amps for construction, ship building and similar applications.
A.O.Smith
NEW WELD-ALL
TWO-TWENTY-FIVE
FOR LIGHT INDUSTRY, MAINTENANCE AND FARM WELDING
Built-in battery charger is handy accessory item. Does double-duty by quick-charging six-volt and twelve-volt batteries in less than an hour-and-a-half — starting charge in 20 minutes. No fuss! To install, just bolt panel in place.
DO-IT-YOURSELF SECTION
MODEL A20S SHOP WELDER — Ideal for parts fabrication and equipment repair. Rated at 200 amps, 50% duty cycle . . . 250 amps, 35% duty cycle...295 amps, 20% duty cycle. 80-volt open circuit voltage assures easy striking and running with all A.C. electrodes. Battery-charging accessory also available.
Here's a "cooperative" welder — one that will iron out difficulties and make the "tough" jobs easy. It does all this: Handles all types of steel . . . accommodates a wide range of electrodes . . . packs a record 225 amps of welding power . . . provides two welding ranges . . . gives exact, stepless current control.
A.O.Smith A.C. WELDER

YOU PAY YOUR MONEY AND TAKE YOUR CHOICE

Why pay your money and take a chance when A. O. Smith gives you your choice — a *value* choice of industry's most complete line of welding equipment and electrodes.

Let's spend some time with that word *value*. In the case of A. O. Smith, value begins at home. Because A. O. Smith is one of the world's largest single users of welding equipment in its own production lines — its research and development efforts are far more extensive than those of other welding equipment manufacturers.

In our tour through the A. O. Smith Weldamart, we have shown you only the high points in the A. O. Smith line. There are hundreds of variations on the equipment shown here. For specific information, write us direct or visit your A. O. Smith welding distributor.

Through research ... *a better way*

A.O.Smith
CORPORATION

WELDING PRODUCTS DIVISION
Milwaukee 1, Wisconsin
A. O. Smith International S.A.
Milwaukee 1, Wis., U.S.A.

Bulletin No. 315
Printed in U.S.A.

Between passes

from Europe

Earlier in the year, Fred Purdy, sales manager of the Westing-Arc Dept. of Westinghouse Electric Corp., made a trip to Great Britain and Sweden on company business. His informative report of that trip has been sent us, and the portion dealing with Swedish welding practices contains some highly interesting observations.

Travelling through the AB Gotaverken shipyard in Goteborg, Fred spotted a semiautomatic CO_2 Mig application on a ship component—an unusual new use for the process that Fred was told had been approved by Sweden's own welding code group and Lloyds of London.

The Westing-Arc representative also noted the universal use there of sand-blasting *before* flame-cutting or welding, as well as the almost complete mechanization of flame-cutting equipment (including a photographic unit that traced cuts automatically from a photo reduced 100 times).

a salesman

Charlie McIntyre is sporting a 50-year service pin and watch these days.

Charlie is sales manager in the Milwaukee district office for United States Steel. One of this nation's best known steel salesmen, he was honored at the firm's annual sales meeting last month in Bedford Springs, Pa. A long-time friend, Howard J. Mullin, vice president of sales, presented McIntyre with the mementos marking his long career with U. S. Steel.

One of 11 children, Charles E. McIntyre was born in Cleveland. He quit school at the age of 14 to join Carnegie Steel Co., a subsidiary of U. S. Steel as an office boy in the Cleveland sales office. His salary: $25 per month. The year was 1911.

Steel was still a young industry. U. S. Steel itself was in business only nine years at that time.

Advancing through various stages, Charlie worked as clerk before becoming assistant manager of the Cleveland office in 1939. He moved to Buffalo that same year as sales manager and remained until 1941 when he was transferred to Detroit. He became Milwaukee sales manager in 1947.

PROFITS are built on DEPENDABILITY

Improve the Quality and Appearance of your welds while you save 20% or more with *Aronson* POSITIONERS

A large mining equipment plant has taken another step forward with the addition of an Aronson 32,000 pound Headstock and Tailstock Positioner in its structural department for the welding of shuttle bodies and frames.

With the installation of Aronson Headstock and Tailstock Positioners the car bodies can easily be rotated into position to bring seams and weld locations in a flat or downhand position. The result is a considerable saving in time, but moreover the quality and appearance of the welds are very superior to previously unpositioned work.

These machines are designed to give long dependable service . . . and profits are Built on Dependability.

ARONSON BUILDS THE MOST COMPLETE LINE OF POSITIONERS
. . . WITH CAPACITIES RANGING FROM 25 POUNDS TO 600 TONS

Universal Balance® Positioners • Bench Turntable Positioners • Gear Driven Positioners
Headstock-Tailstock Positioners • TracTred® Turning Rolls • Turntables
Fully Automatic Positioners • Geared Elevation Positioners • Magnetic Welding Clamps

Quality PRODUCTS by *Aronson* MACHINE COMPANY, INC.
Write for detailed engineering data
ARCADE, NEW YORK

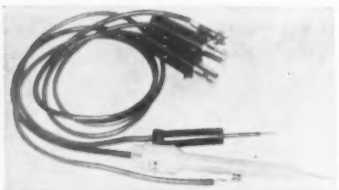
For more information, fold out Welding Info-Aid card on page 87 and circle appropriate numbers as you read.

NEW PRODUCTS for you

Electronic unit provides remote control of welding amperage

Electronic welding control provides remote fingertip control of welder amperage. By touching a button, the amperage on the machine—located a distance away—is increased or decreased electronically as you choose. With close heat control, spatter can be reduced and time saved by eliminating trips for amp adjustment. Unit comes in compact package of motor, mounting screws and welding electrode holder with control, and 25 ft. of welding cable. Control is suited for operations such as production, shipyard use, maintenance, construction. **Mars Industries Inc.**

Circle No. 1 on Info-Aid Card.



Pencil probe welder joins thin metals

Pressure-sensing pencil-probe welding handpiece facilitates small pinpoint welds made from one side of work surface. VTA-43 includes pressure-sensing weld probe and ground probe. Probe is adjustable to fire weld energy at ½ to 5-lb preset pressures for welding hard-to-get-at thin metals such as found in electronic component assembly. Unit weighs 6 oz without cables. Three feet of cable with Camlock B-002 plugs are supplied. **Hughes Aircraft Co.**

Circle No. 2 on Info-Aid Card.

Extruded coated electrode welds aluminum

Aluminum electrode with extruded coating is designed for all-position welding with d-c reverse polarity. Electrode can be used to join aluminum plate, sheet and casting. Airco 43 provides tensile strength yields up to 28,000 psi. Electrode comes 1/8-in. diameter 14-in. long or 5/32-in. diameter 16-in. long. **Air Reduction Sales Co.**

Circle No. 3 on Info-Aid Card.

Temperature-indicators come in aerosol cans

A total of 44 systematically-spaced temperature-indicating coatings are available in aerosol form — spaning range of 100 F to 1,000 F. Coatings can be used for nondestructive testing of honeycomb panels, monitoring operating temperatures of reaction vessels; fabricating massive structures; heating, preheating and stress relieving large areas. **Tempil Corp.**

Circle No. 4 on Info-Aid Card.

55,000-psi bronze is low fuming

Low-fuming bronze is designed for pricing competitively with imported bronze. Bare bronze is same composition as wire used with firm's extrusion-flux-coated low-fuming bronze. Ultimate tensile strength of bronze is 55,000 psi. **All-State Welding Alloys Co., Inc.**

Circle No. 5 on Info-Aid Card.

13-oz fiber helmet has aluminum plate holder

Fiber welding helmet weighs 13 oz and features aluminum plate holder. Helmet has adjustable friction joints and adjustable headgear. Seams are widely overlapped and coated with rubber sealant. Helmet is recommended for light welding, intermittent use and for use in confined quarters. **American Optical Co.**

Circle No. 6 on Info-Aid Card.

Plasma equipment can generate 30,000 F

Plasma spraying and generating equipment can generate temperatures in excess of 30,000 F. Equipment can be used to spray any meltable material. Even refractory metal coatings can be sprayed. Controls are automatic. Hand-held unit can be used for cutting, welding and heat treating. **Precise Metal Products Corp.**

Circle No. 7 on Info-Aid Card.

Not to be overlooked

Oerlikon welding electrodes are manufactured in:

	Switzerland	
Argentina	Germany	Philippines
Austria	Gt. Britain	Spain
Chile	Greece	Sweden
Colombia	India	Turkey
Finland	Italy	USA
France	Japan	
	Mexico	
	Pakistan	
	Peru	

D&N

Welding Electrode Division, Oerlikon Machine Tool Works Buehrle & Co, Zurich 50/Switzerland

For more facts Circle No. 163 on Welding Info-Aid Card

SPECIAL MONEY-SAVING OFFER!

For Light Welding & Cutting:

NEW PUROX 100 ONE HUNDRED OUTFIT

$114.62 value for only $100.00

YOU SAVE $14.62!

Ideal for light-duty production, repair, maintenance work. Use the PUROX "100" oxy-acetylene outfit on aircraft, small parts, light machinery, sheet metal assemblies. Pocket-sized regulators and compact torch make it extra small, portable (entire unit weighs less than 10 lbs.). Welds up to 3/8", cuts up to 2". Additional heads and nozzles available to extend range. Elimination of metal-to-metal gas seals adds years of useful life.

For Medium Welding & Cutting:

NEW PUROX 130 ONE THIRTY OUTFIT

$148.07 value for only $130.00

YOU SAVE $18.07!

Meets any shop's medium-range oxy-acetylene needs . . . on production lines, in garages and repair facilities, on pipe welding jobs, in tool, die, maintenance departments. *Easy to use*—no need to re-adjust regulators when you switch jobs. *Reliable*—flame won't sputter or pop regardless of size, valve-throttle or regulator settings. Lightweight, easily portable, economical to buy and use. Welds up to 3/8", cuts up to 4".

Your LINDE Distributor — Where One Call Gets It All

Your nearby LINDE distributor has both these PUROX kits in stock now. For his location, check your Yellow Pages or write Linde Company, Division of Union Carbide Corporation, 270 Park Ave., New York 17, N. Y. *In Canada:* Union Carbide Canada Limited, Linde Gases Division, Toronto 12.

LINDE COMPANY

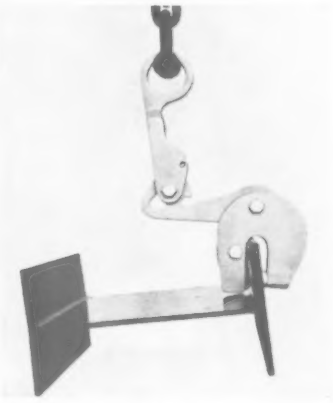
UNION CARBIDE

"Linde," "Purox," and "Union Carbide" are registered trade marks of Union Carbide Corporation.

Soldering tool needs no flame or electricity

Hotspot soldering tool requires no flame, electricity or external heat of any kind. Tool heats itself with tiny cartridge in top. Cartridge is actuated by releasing spring rod in handle. Tip heats to 862 F in seconds. **Standard Automation Products.**

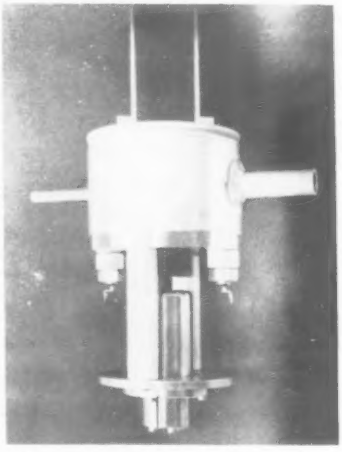
Circle No. 8 on Info-Aid Card.



Lifting clamp has automatic release

Model STL and ST lifting clamps have automatic release mechanism which allows crane operator to disengage clamp without assistance from ground. Clamps allow a positive grip on I beams and structural shapes. Both clamps have gripping ratio of 3 3/4 to 1 and are made of heat-treated tool steel. Various jaw openings and tonnage capacities are available. **J. C. Renfroe & Sons, Inc.**

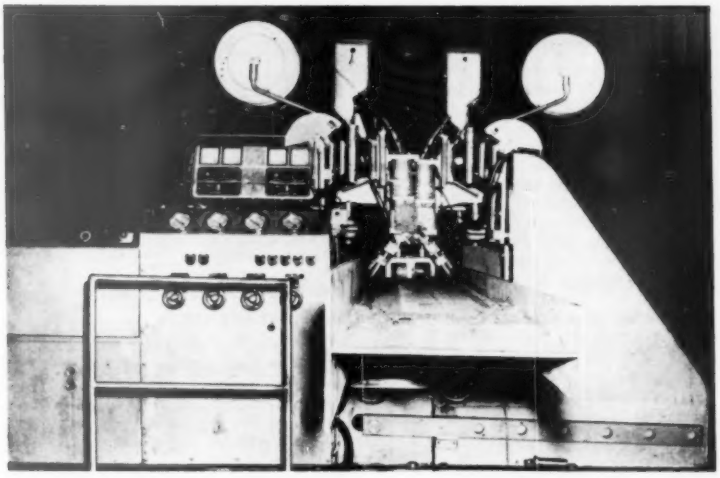
Circle No. 9 on Info-Aid Card.



Electron beam gun welds reactive metals

Electron beam gun is designed to weld refractory and reactive metals. Model 2025G is self-accelerated and can move beam electronically within 3-in. circle. Gun can be operated in standard stainless steel bell jars or larger chamber. **High Vacuum Equipment Corp.**

Circle No. 10 on Info-Aid Card.



Automatic welding unit produces various profiles

Automatic submerged arc welder produces beams of various profiles. I-beams, U-beams and T-profiles are fabricated from plate cut to required width and length. Machine can also weld tubes. Unit includes: feeder, two or four automatic welders and corresponding generators. Unit produces tailor-made beams when needed to reduce stock-piling and storage. **American Pullmax Co., Inc.**

Circle No. 11 on Info-Aid Card.

Electrodes are each marked for safety

Welding electrodes used on critical work such as nuclear components are individually marked for inspection. Each electrode is subjected to a test and passed as safe with appropriate AWS grade designation marked legibly at frequent intervals lengthwise on the electrode. **Arcos Corp.**

Circle No. 12 on Info-Aid Card.

Hardfacing electrodes available 18-in. long

A and BX hardfacing electrodes 3/16 in. and ¼ in. are available in 18-in. lengths. Electrodes are also offered in standard 5/16-in. diameter. **Rankin Mfg. Co.**

Circle No. 13 on Info-Aid Card.

Blast control unit saves abrasive material

Abrasive-miser blast control saves the most expensive blasting item—the abrasive. Blast machine is held under pressure constantly to eliminate waiting for pot to pressurize. Manual or automatic control makes moving around on scaffolding easier and safer. Control will fit on any blast hose in minutes without repiping or added connections. **L. C. Nesham Products.**

Circle No. 14 on Info-Aid Card.

Micro-ground flux extruded on alloys

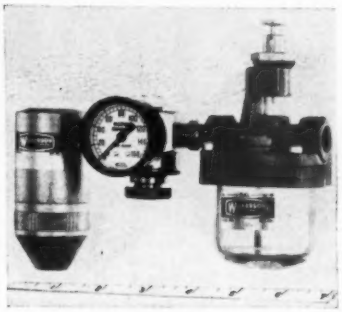
Non-charring chip-resistant micro-ground flux has been extruded on three standard brazing alloys. Nos. 11, 13 and 41 for nickel-silver build-up and general brazing have the new flux coating. **All-State Welding Alloys Co., Inc.**

Circle No. 15 on Info-Aid Card.

Resinoid bond developed for diamond wheels

B-56 resinoid bond for diamond wheels allows one wheel to economically grind carbide wet or dry. Bond gives increased wheel life. Wheels with new bond come in all sizes and shapes. **Norton Co.**

Circle No. 16 on Info-Aid Card.



Unit filters, regulates, lubricates compressed air

Combomatic unit filters, regulates and lubricates compressed air. Unit is 7-in. long and 4 3/4-in. high. Completely automatic drain trap is included on filter. Model 64240-2 has 12 cfm at 100 psi air pressure capacity and is available from stock in ¼-in. **P. T. Wilkerson Corp.**

Circle No. 17 on Info-Aid Card.

—your LINDE distributor!

These days, more and more developments in welding hold the solution to knotty metalworking problems. The efficiency, economy, and versatility of modern welding methods and equipment are benefits which you should know about when joining or cutting metals.

Your nearby LINDE distributor is the best man to give you help. He is an independent local business man, easy to reach and talk to, fully stocked with a complete line, familiar with local industry. And he's backed by LINDE's technological leadership of more than 50 years' standing. Just as he can give fast delivery of all the superior equipment and materials you need—he can get you the specialized, and profitable, answers to your questions as they come up in the field.

Prove it to yourself—call your nearby LINDE distributor. He's in the classified directory. He is as close as your telephone. Or, write for his address to Linde Company, Division of Union Carbide Corporation, 270 Park Avenue, New York 17, N.Y. *In Canada:* Union Carbide Canada Limited, Linde Gases Division, Toronto 12.

Your LINDE Distributor

"Where One Call Gets It All"

LINDE COMPANY

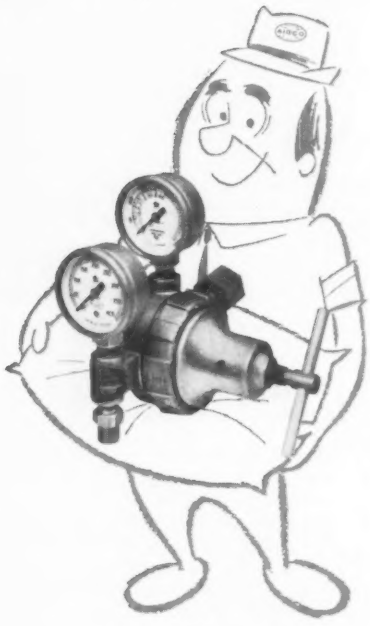
UNION CARBIDE

"Linde" and "Union Carbide" are registered trade marks of Union Carbide Corporation.

Airco design scoop!—

NEW 9100 SERIES

INDUSTRIAL GAS REGULATORS



Top quality equipment at lower cost—for welding, cutting, brazing, heating

Inverse type seat design gives you the constant working pressure you need—right up to the cylinder's "empty" point . . . *Exclusive large diaphragm plate design* gives precise pressure regulation in a small regulator body—no bulky case required . . . *Phase dampening* keeps internal friction low, response to pressure change smooth and accurate.

This is Airco's new, full size, single stage 9100 Series—industry's finest industrial gas regulators at a new low price.

Phone your nearby Airco Distributor now. Let him fill all your welding and cutting needs. He's listed in your Classified Telephone Directory under "Welding Equipment and Supplies."

AIR REDUCTION

. . . represented by over 700 Authorized Airco Distributors from Coast to Coast

AUTHORIZED AIRCO DISTRIBUTOR ®

Circle No. 164 on Welding Info-Aid Card

Punch press has 72-in. by 48-in. table

Super 30 single-station punch press has one-piece 72-in. by 48-in. ground steel table which can be adjusted to any height down to 3 in. below die level. Press can punch round and shaped holes up to 3½-in. diameter in up to ¼-in. mild steel. It can notch corners, radii and vees in ⅛-in. material and nibble straight lines or contour patterns in ⅛-in. stock. Machine will handle stock up to 60-in. wide. by any practical length. **Wales Strippit, Inc.**

Circle No. 18 on Info-Aid Card.

Automatic torch saves gas and oxygen

New 18-2F automatic torch offers savings in gas and oxygen. Torch has serrated thumb control which reduces flame to pilot light when turned to "off" position. "On" restores original pre-set flame. **The Harris Calorific Co.**

Circle No. 19 on Info-Aid Card.

Heating device prepares thermoplastic sheets

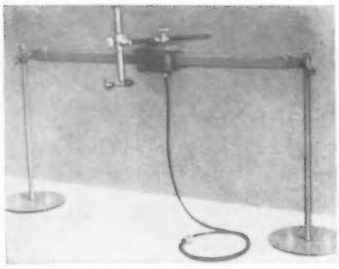
Heating device reduces time for bending themoplastic sheets. Device permits single and double bends. It consists of two rectangular aluminum heating bars and comes in two models for 36-in. and 54-in.-wide sheets. **Kamweld Products Co.**

Circle No. 20 on Info-Aid Card.

150-curie moble unit handles industrial inspection

Tech Ops Model 520 150-curie cobalt unit can be used for directional or panoramic industrial inspection. Unit is ideal for steel fabricators in high-production radiography of heavy sections. It requires an exposure time only 7% of that required by 10-curie source. Unit comes in either mobile hydraulic mount or "A" frame when added mobility is not required. **Picker X-Ray Corp.**

Circle No. 21 on Info-Aid Card.



Portable seamer comes with stanchions

Portable seamer with pair of self-supporting stanchions can be used for welding or cutting on sloping and vertical surfaces in addition to a horizontal plane. Stanchions are adjustable independently for use on uneven floors. Carriage is driven by variable-speed 110-volt a-c/d-c motor which gives infinite output speeds over range of 8 to 120 ipm. **Cayuga Machine & Fabricating Co.**

Circle No. 22 on Info-Aid Card.

Transistor welders control back pressure

Back pressure can be controlled more precisely with new control system for transistor welding machines. System adjusts for, and then automatically regulates, welding pressure. Machine operator varies back stroke of air cylinder from 2-in. maximum by means of mechanical arrangement. **Thomas Electric Welder Co.**

Circle No. 23 on Info-Aid Card.

Tig torches have special ceramic cups

Special grade ceramic cup with internal and external radii is standard equipment on firm's Tig torches. Cup is designed to reduce cup breakage caused by thermal shock and to surround electrode with even, uniform gas flow. **Falstrom Co.**

Circle No. 24 on Info-Aid Card.

Electrodes handle gouging, piercing

Groovees electrodes are designed for gouging and piercing. Electrodes require no oxygen or air supply. They can be used with a-c or d-c without additional attachments and they are free from carbon pick-up. **Aufhauser Bros.**

Circle No. 25 on Info-Aid Card.

Rectifier-welder handles welding, cutting, gouging

Lowboy silicon d-c rectifier-welder is designed for arc welding, cutting or gouging. Single dial controls entire welding range of machine which has no moving coils or cores. Optional remote control and low design for stacking are other features. Silicon rectifiers are permanently sealed. Built-in surge protector prevents possibility of voltage pulses damaging rectifiers. Available with 60% duty cycle ratings of 200 and 300 amp. **Hobart Bros. Co.**

Circle No. 26 on Info-Aid Card.

Tiny pressure regulator regulates to 400 psi

Model 2017 pressure regulator with gage port and Model 2018 without are 2¼-in. high and 1 7/16-in. wide. Both are standard with ¼-in. NPT inlet and outlet, but 1/8 in. NPT connections are available. Regulator can be used on pneumatic instruments. It regulates up to 400 psi or 5-125 psi secondary pressure range. Delivers up to 80 cfm at 100 psi with 200-psi inlet pressure. **Wilkerson Corp.**

Circle No. 27 on Info-Aid Card.

Grinding wheel eliminates special adaptor kits

Topper 3-ply grinding wheel has bonded-on ⅝-11 Hub which eliminates need for special adaptor kits or assemblies. Wheel features three layers of reinforcing fibre glass. Designed especially for maximum effectiveness on high-speed, air-driven or electric portable grinders that operate 5,200 rpm or more. Wheels are available in 7¼ in. and 9¼ in. **George H. Bullard Co.**

Circle No. 28 on Info-Aid Card.

By the Manufacturers of Famous

ATLAS WIDE-BLADE **TOMAHAWKS**

WORLDS LEADING WELD CLEANING TOOLS

4 NEW ACCESSORIES

To Make The Welder's Job Easier!

FAST DRAW "SAFETY" HOLSTERS

MODEL 19 HOLDS ANY KIND OF HAMMER

$1.95

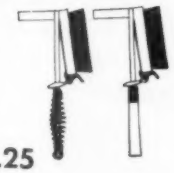
Holster made of heavy full grain saddle leather with belt loop adjustable to 5 lengths. For welders, plumbers, carpenters, millwrights.

MODEL 192 DUAL CASE HOLDS TOMAHAWK & 10 LBS. WELDING RODS

A supply of rods and the Atlas Tomahawk of your choice at your side where you can grab them without even looking. This case has a flat bottom and will stand if you choose not to wear it while working. Heavy full grain saddle leather.

$4.75

MODEL 21 FOR CARRYING ANY COMBINATION WELD CLEANING TOOL



$3.25

Holds Atlas "Dual Tool" or any chipper-brush tool. Protects the welder's fingers and clothing. Prevents brush getting frayed. 5 adjustments on belt loop. Heavy full grain saddle leather.

MODEL 15 SAFETY BELT

Heavy webbing with rust proof ring and snap. Wear it over your coveralls as a belt or shoulder strap to carry equipment.

$2.25

Tough as they come!

Atlas makes 33 different weld cleaning tools. There's one for every purpose and preference—Ask your welding supply dealer to show them to you.

ATLAS WELDING ACCESSORIES INCORPORATED
707 E. LEWISTON
FERNDALE 20, MICH.

For more facts Circle No. 166 on Welding Info-Aid Card

PNEUMATICALLY OPERATED

Eliminate weld slag, rust, old paint, clean concrete and rake joints fast and effectively with the VON ARX AIR GUN.

LARGER MODELS AVAILABLE

The VON ARX AIR GUN contains a series of hardened steel needles which adjust to the contour of the surface being cleaned.

Available in four sizes, there is a VON ARX AIR GUN to fit every job, large or small. For further information or demonstrations, write or call . . .

EASILY CLEANS HARD-TO-GET-AT AREAS

T. G. CULLEN • 3710 GRAND AVENUE OAKLAND 10, CALIF. PHONE GL 2-3982

C. J. BREITENSTEIN
8805 SHERIDAN DR • BUFFALO 21, N. Y. • NF 2-8375

NEW from GLENDALE

No. GW600

Unisite Welding Goggle

The only WELDING GOGGLE ever designed to carry a magnifier

- 6-way baffled vents give maximum, fog-free vision
- Fits all facial contours easily and comfortably
- Magnifier snaps into place —no tools or fuss.
- 2" x 4¼" standard plate conforms to Federal Specification GGG-H-211a
- Easy front loading. Slide to open and to close.
- Simple lens replacement
- Will not warp or distort under heat

The finest single-plate goggle ever made for use with or without magnification

Details and specifications on request
Write for new 1961 catalog

GLENDALE OPTICAL CO., INC.
600 W. MERRICK ROAD, VALLEY STREAM, N. Y.
• S-7 SPECTACLES & LENSES • FACE SHIELDS • WELDER'S AND CHIPPER'S GOGGLES • DUST GOGGLES • ACID & CHEMICAL GOGGLES • FLASH SPECTACLES • PLASTIC EYESHIELDS • CHIPPING & GRINDING SPECTACLES • WELDING PLATES & LENSES

Welding cable is safety colored

Vu-tron 7 safety-colored welding cable is flame and weather resistant. In tests for general abrasion, cable performed better than chloroprene or synthetic rubber. Following 3,000 hours of exposure to ozone at 100 F, cable, unlike rubber, showed no cracks and volume swell was negligible. Cable is available in 250-ft, 500-ft and 1,000-ft reels. **Carol Cable Co.**

Circle No. 29 on Info-Aid Card.

160-amp Tig holder is air cooled

Manual 160-amp Tig holder features thumb-operated gas valve. HI6-B is a-c d-c air-cooled unit with various nozzle orifice sizes available in 1¼ and 1⅝-in. lengths. Tungsten electrodes from 0.20 through 5/32-in. diameters and from 2 to 7-in. long can be accommodated. Argon, helium or mixtures of the two can be used as shielding gas. **Air Reduction Sales Co.**

Circle No. 30 on Info-Aid Card.

Fire extinguishers handle all types of fire

New 10 and 20-lb portable fire extinguishers are U. L. approved for use on all kinds of fires. They bear U. L. ratings of 2-A, 16-B:C and 3-A, 20-B:C respectively. Approved for non-metallic fire hazards, extinguishers are simple to operate. **Walter Kidde & Co., Inc.**

Circle No. 31 on Info-Aid Card.

Induction heater is 450-kc 150-kw unit

Electronic induction heating unit is rated at 150-kw continuous duty and 450 kc. Sufficient power is built in to deliver full output 40 ft from generator. Totally enclosed unit features push-button operation and thermostatic controls to keep raw water consumption at a minimum. **Induction Heating Corp.**

Circle No. 32 on Info-Aid Card.

For more facts Circle No. 167 on Welding Info-Aid Card

Dial thermometer controls preheat

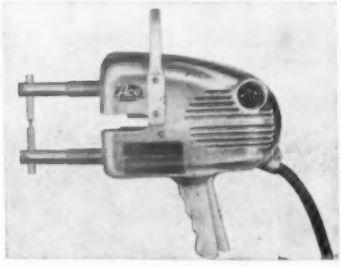
Magnetically-attaching bi-metal dial thermometers can be used for temperature measurement and control in preheating. Thermometers come for temperature measurement only, with maximum reset hand, or with electric contactor for on-off temperature control with electric resistance or induction heating. Available in temperature ranges from −60 F to 700 F with 2% accuracy. **Industrial Service Co.**

Circle No. 33 on Info-Aid Card.

Engine-generators have 1, 2 or 4 cylinders

J Series of 12 engines, with generators to match, are available with 1, 2 and 4 cylinders. Engines are available with water or air cooling and gas, gasoline or diesel power. Parts are interchangeable with other engines in series. **Onan Div.**

Circle No. 34 on Info-Aid Card.



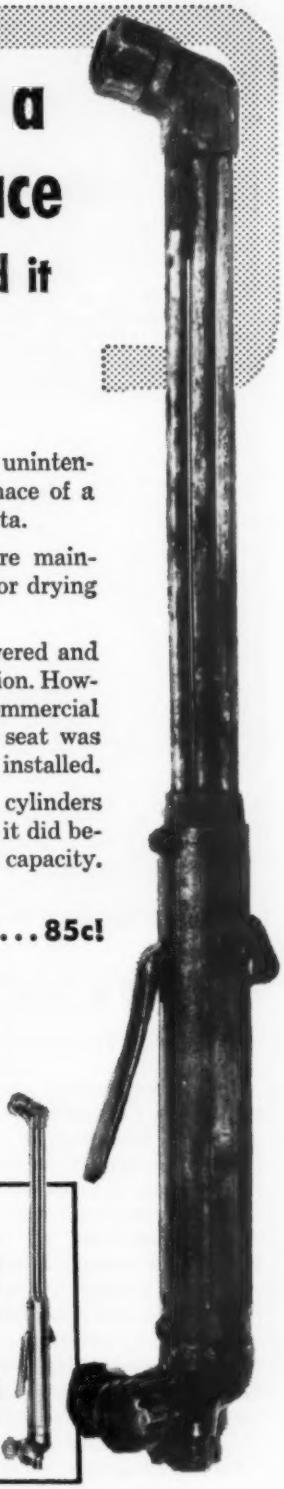
Portable spot welder has built-in timer

Portable resistance spot welder has built-in timer. Capacity is 3/16-in. for cold-rolled steel and up to ¼-in. combined thickness for stainless, galvanized and cadmium-plated steel. Applications include cabinet work, shelving, furniture, racks and machinery work, farm implement repair, body and fender work, sheet metal fabrication gutter work and stud welding. Unit can produce 200 to 300 welds per hr. Timer adjusts from 1/60 sec to a full second. Features are 100-amp contactor, construction permitting 1,000-lb pressure at tips, and 3-in. tip opening with 7-in. throat depth. **Ace-Sycamore, Inc.**

Circle No. 35 on Info-Aid Card.

280 days in a taconite furnace

(and 85¢ in parts had it cutting again!)



In June, 1960, the torch shown was unintentionally left in a taconite pellet furnace of a processing plant in northern Minnesota.

Temperatures of 1400° to 1500° are maintained in the furnace which is used for drying and curing of taconite pellets.

9 months later, the torch was discovered and removed, in apparently useless condition. However, it was placed in a vat of commercial solvent for half an hour; the valve seat was replaced and two new "o" rings were installed.

It was then connected to a pair of cylinders and it made the same perfect cuts as it did before its hot vacation. No leaks. Full capacity.

Total cost for repair parts... 85c!

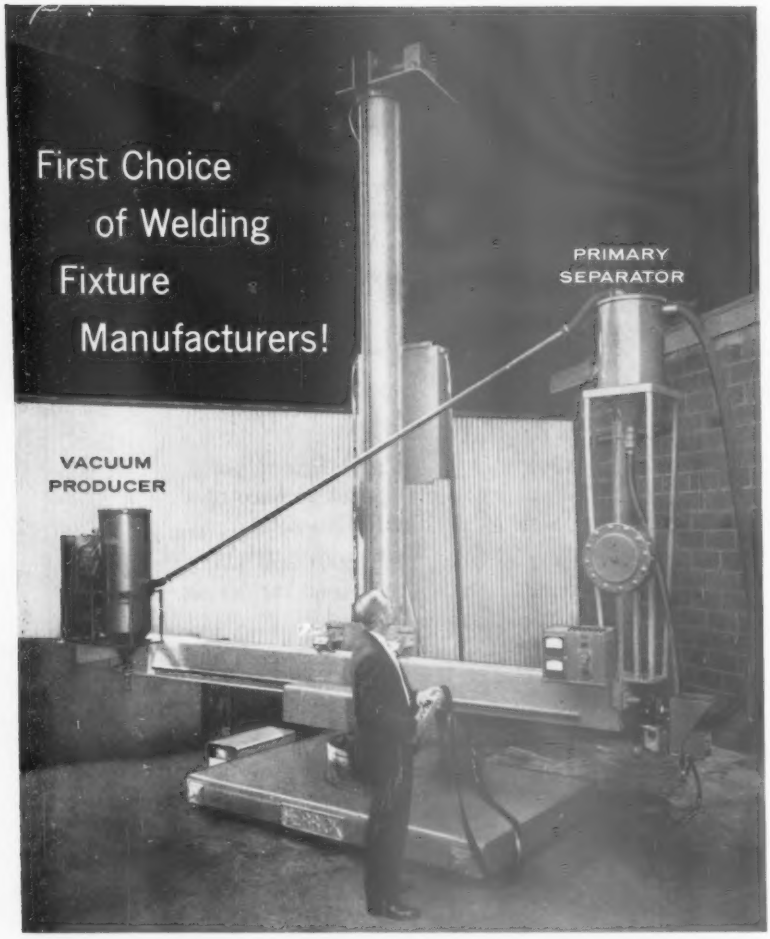
Your torches may never be subjected to this kind of treatment, but the point is that the torch pictured is built to outperform and outlast the finest — saving down time and repair costs.

Incidentally, Smith's Flat Rate Exchange program would provide a rebuilt, newly guaranteed torch for $16 if extensive repair had been necessary.

The torch is Smith's famous Silver Star SC229. Why not call your Smith distributor for a demonstration?

SMITH'S®

SMITH WELDING EQUIPMENT
DIVISION OF TESCOM CORPORATION
27TH AVE. and FOURTH ST. S. E.
MINNEAPOLIS 14, MINNESOTA



INVINCIBLE UNITS

Automatically Reclaim Flux

This automatic ram type manipulator made by C. B. Herrick Manufacturing Corp., Cleveland, is used for welding steel plate bridge girders. Mounted on the carriage, an Invincible Flux Recovery Unit travels with the welder along the full length (up to 130 feet) of the girder. It recovers all unfused flux . . . removes powder . . . and returns slag-free, dust-free flux to the welder automatically, in a continuous flow.

Fixture manufacturers—and users—specify Invincibles because they are engineered specially for handling abrasive materials and for continuous operation. Their rugged construction assures years of full-time operation—no loss of production time.

Savings in reclaimed flux alone pay their cost in a few months, even weeks. In addition, Invincibles save costly man-hours over manual methods, speed-up production, minimize rejects.

In 14 standard automatic and manual models (1½ to 7½ H.P.). Accurate free surveys of your submerged arc welding operations can be made on short notice. Resident engineers in all principal cities.

Send for Invincible Flux Recovery Equipment Folder.

INVINCIBLE VACUUM CLEANER MFG. CO.
DOVER, OHIO

Plastic hard hats are moisture proof

Moisture-proof plastic hard hats and caps have no metal parts to conduct electricity. Goggles, helmets and faceshields may be attached to these caps and hats without the need for drilling holes. Dura-Guard hats adjust from size 6¼ to 8. Break-away chin strap is available to prevent possible strangulation. **American Optical Co.**

Circle No. 36 on Info-Aid Card.

Unit cuts variety of plate edges

PE-I plate edge preparation unit cuts variety of profiles. Unit uses standard machine cutting torches with acetylene, natural gas or propane. Unit cuts standard straight edges as well as single bevels, double bevels or bevels with a nose. Ideal for applications where heavy plate edges must be prepared with variety of edge contours. **Linde Co.**

Circle No. 37 on Info-Aid Card.

Abrasive blaster is portable one-man unit

Little Sputz Blaster can be carried and operated by one man alone even in hard-to-reach places. Abrasive blaster can be pulled on wheels or carried. Machine is built to roll away when struck accidentally. Automatic controls are available. **Andersen Mfg. Co.**

Circle No. 38 on Info-Aid Card.

Multi-stage regulators are infinitely adjustable

Multi-stage regulators feature infinitely-adjustable first stage delivery pressure. This enables second stage to control constant flow accurately as cylinder pressure reduces. Model 82-3 regulators are available for all commercial gases. **The Harris Calorific Co.**

Circle No. 39 on Info-Aid Card.

500-amp Tig torch is one-piece unit

One-piece 500-amp Tig torch features tip-of-torch cooling which eliminates cooling time. No. 421 heavy-duty torch is easily adapted to all of firm's standard Vycor nozzles and chucks. Torch is 9-in. long and weighs 5½ oz. **Tec Torch Co., Inc.**

Circle No. 40 on Info-Aid Card.

Electron beam system handles welding, melting

LB-100 series electron beam systems can be used for welding, melting or etching patterns. Systems cover range from 3 kw at 10,000 volts to 9 kw at 30,000 volts. Systems can also be used for refining, glazing, brazing, surface conditioning and other uses. **GVC Electron Heating Corp.**

Circle No. 56 on Info-Aid Card.

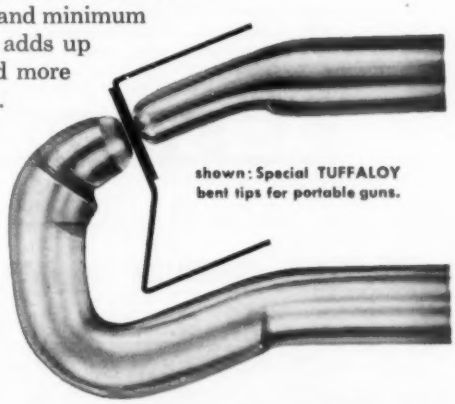
Weldor's glove fits either hand

Solo weldor's glove is reversible and thus will fit either hand. Because right and left are identical, gloves can be purchased singly instead of in pairs. Gloves are tanned cowhide treated for softness and shrink-resistance. Color is green. Cuff is flame-resistant olive drab duck with red binding. **Singer Glove Mfg. Co.**

Circle No. 41 on Info-Aid Card.

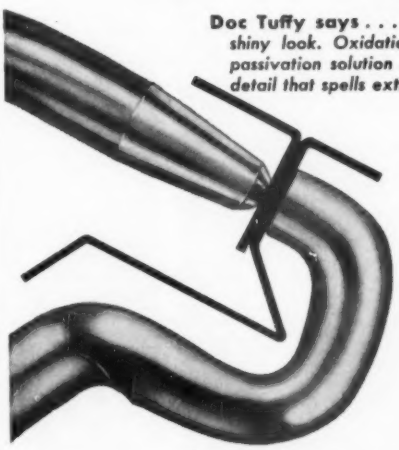
The Strongest Bent Tips Come From TUFFALOY

You get more spot welds for your money when you buy TUFFALOY bent tips. These electrodes are bent to precise angles so skillfully that there's no sacrifice of the wall strength needed to withstand heavy forging pressures. Examine a TUFFALOY bent-tip—the diameter remains constant and the coolant hole is unobstructed. So carefully is the job done that there's no cave-in at the outside of the bend, and minimum swelling at the sides. This adds up to longer electrode life, and more spot welds for your money.



shown: Special TUFFALOY bent tips for portable guns.

Doc Tuffy says . . . All TUFFALOY tips keep their bright and shiny look. Oxidation is inhibited by dipping the parts in a passivation solution . . . another example of our attention-to-detail that spells extra value for you.



Write or call your nearest AIRCO or TUFFALOY distributor for more information about TUFFALOY bent tips. Many styles are stocked as standard items, and special designs are quickly made to order. Be sure to ask for the TUFFALOY Catalog.

AIRCO

AIR REDUCTION SALES COMPANY

A division of Air Reduction Company, Incorporated

150 East 42nd Street, New York 17, N. Y.

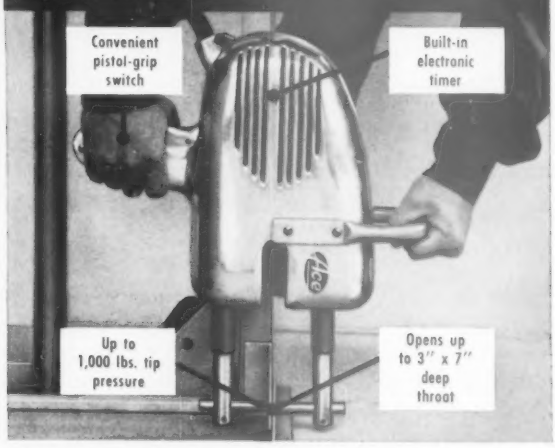
More than 700 Authorized Airco Distributors Coast to Coast

On the west coast: Air Reduction Pacific Company, **Internationally:** Airco Company International, **In Canada:** Air Reduction Canada Limited

ALL ARE DIVISIONS OR SUBSIDIARIES OF AIR REDUCTION COMPANY, INC.

For more facts Circle No. 171 on Welding Info-Aid Card

NEW Ace "44"
PORTABLE SPOT WELDER



1001 uses in maintenance, construction and light production (up to 300 welds per hour). Welds sheets, bars, rods, etc. Capacity up to 3/16" mild steel. Secondary output—8200 amp. (short circuit), 2 volts. Air cooled. Weight 26 lbs. Here's a real "He-man" welder with plenty of "built-in" power. Write for folder FORM WB-961.

ACE-SYCAMORE, INC.
450 DEKALB AVENUE • SYCAMORE, ILLINOIS

THE PERFECT COMBINATION FOR FASTER, BETTER, MONEY-SAVING
GRINDING & CUT-OFF OPERATIONS

A. E. G. UNIVERSAL ANGLE GRINDERS
perform the toughest jobs with SPEED, ACCURACY, SAFETY.
Equipped with 2HP heavy duty motor, the 7" model runs at 8,000 RPM, the 9" model at 6,600 RPM increasing operational performance over conventional electric and airpowered angle grinders.

A. E. G. is not just another grinder but offers unmatched efficiency, usefulness and versatility. Ingenious optional low cost accessories let A.E.G. do work normally requiring costly special machinery and equipment.

Convert your A. E. G. portable grinder instantly into a sturdy, powerful Stationary Cut-Off-machine.

An industrial workhorse; A.E.G. fills the need for a reliable, strong truly high-speed production grinder.

Approved by Underwriters Laboratories Inc.

THE PERFECT MULTI-PURPOSE POWER TOOL AT LOW BUDGET PRICE . . . THE IDEAL CHOICE OF SMALL SHOPS AND LARGE PLANTS ALIKE.

"IPAFLEX" REINFORCED DEPRESSED CENTER and "IPACUT" REINFORCED CUT-OFF WHEELS
are approved for 8,000 RPM on 7" wheels and 6,600 RPM on 9" wheels.

"IPAFLEX" wheels are reinforced and resinbonded for maximum safety. They are fast, long-lasting and economical for weld-and stock removal, deburring and all other metal removing jobs.

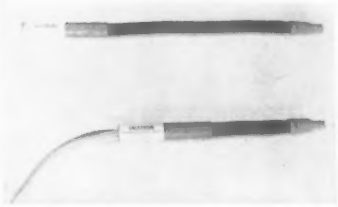
"IPACUT" reinforced and resinbonded Cut-Off wheels are designed and approved for all high speed grinders and cut-off machines: Quality guaranteed for cutting off rods, pipe, tubes, bars and many non-metals.

"IPAFLEX" and "IPACUT" wheels are priced to substantially reduce your grinding wheel cost. — Ideal for tool rooms, welding and machine shops, structural iron and metal works, building and electrical contractors.

CASH IN ON BETTER AND FASTER RESULTS . . . USE "IPAFLEX" AND "INPACUT" WHEELS WITH A.E.G. GRINDERS.

Dealer inquiries invited — Write for free literature and price lists.

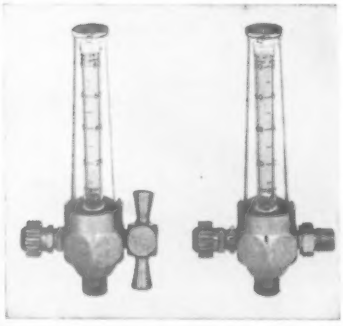
BRUNMAR COMMERCIAL CORP.
Abrasive Sales Div.
57 PRINCE STREET NEW YORK 12, N. Y.
Phone WAlker 5-3317



Flexible Tig torch has 9-in.-long body

Controlled-angle flexible Tig torch has a 9-in body for difficult-to-reach recesses and angles. Torch moves 180 deg in any direction and will even double back, and bend around corners. Torch features: water-cooled head, telescoping handle, positive-grip metal collet, and lead-coated copper-braided power cable surrounded by water in plastic tube. Model with 6-in. body is also available. **Falstrom Co.**

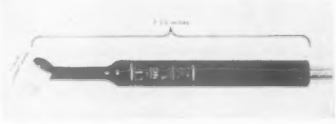
Circle No. 43 on Info-Aid Card.



Flowmeter features interchangeable tubes

Flowmeter features interchangeability of calibrated pyrex tubes for all cylinder gases and flow capacities. Calibrated pyrex tube may be turned in any direction by removing outer flowmeter shell. Flowmeter is adaptable for any positioning or on any standard flow capacity of any cylinder gas by exchanging of tube. **National Welding Equipment Co.**

Circle No. 44 on Info-Aid Card.



Lightweight Tig torch weighs only 2½ oz.

HW-24 is 2½-oz Tig torch ideal for hard-to-reach joints. Average head length of 1 in., depending on cup size, allows welding in areas with 1¼-in. clearance. Torch is rated 75 amp continuous-duty with high-frequency stabilized a-c or straight polarity d-c. It uses 0.020, 0.040 and 1/16-in. electrodes pure or thoriated tungsten with 7/16-in. electrode adjustment range. Torch is 7½-in. long **Linde Co.**

Circle No. 45 on Info-Aid Card.

LINDE ELECTRIC WELDING

PLASMARC

New...very-thin, fused deposits with controlled dilution
New...high-speed, dross-free cuts in 5-in. thick metals

LINDE, inventor of plasma arc processes, announces *new* PLASMARC weld surfacing and *advanced* PLASMARC cutting. What is plasma arc? It is a flow of gas forced through an electric arc, constricted in a small-bore torch nozzle, and accelerated to form an intense jet. It combines electrical heat with the latent heat of highly-excited ionized gas atoms to reach one of the highest known metal-working temperatures (30,000° F.). It will melt any known metal.

A TRUE WELD

PLASMARC *weld surfacing* is true welding—not coating or plating—achieved by feeding powdered metal through the plasma arc into a weld puddle which freezes to form the deposit. Its precision eliminates excess buildup—ideal for such parts as valves, plowshares, seals . . .

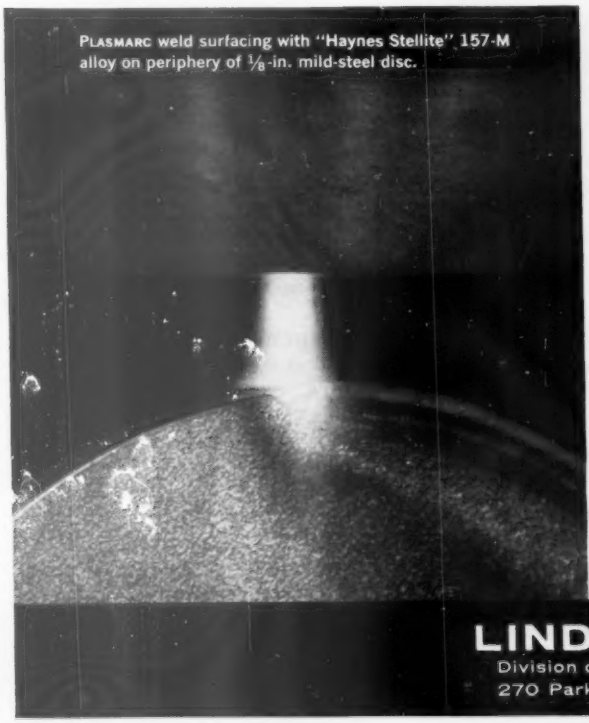
PLASMARC weld surfacing gives precise control of penetration of overlay metal into base metal—as little as .005 in. or higher. Gives precise control of dilution with base metal—from 5% up to 50%. Provides one-pass deposits as thin as .010 in., as thick as 3/16 in., with a wide range of metals and alloys. Produces widths from ⅛ in. to 1 in. or more, speeds over 20 ipm at 95% deposition efficiency, flatter and smoother deposits than other fusion processes.

4000 FT./SEC. VELOCITY

PLASMARC *cutting* uses a near-sonic velocity plasma jet (4000 ft./sec.). It easily melts-and-forces a narrow kerf through both ferrous and non-ferrous metals with little or no change in metallurgical properties. After six years' success, it is replacing shearing, sawing and powder cutting—slower methods which often require machining of the cut edge.

PLASMARC cutting has been further developed—heavy-duty equipment, higher current capacity—to handle increased metal thicknesses. It cuts aluminum, magnesium and copper up to 5-in. thick and stainless steel up to 2 in. thick, dross-free. It clean-cuts 4-in. thick stainless, nickel, carbon steel (requires no iron powder), "Monel," "Inconel," cast iron, high-alloy and clad steels. It makes precise, high-speed cuts up to 300 ipm, holds tolerances to 1/16 in., leaves a heat band as thin as .006-in. wide.

Get full details . . . see a "live" PLASMARC demonstration. Contact your local LINDE office or write direct.



PLASMARC weld surfacing with "Haynes Stellite" 157-M alloy on periphery of ⅛-in. mild-steel disc.

PLASMARC cutting 3-in. aluminum, dross-free, at 20 ipm.

LINDE COMPANY
Division of Union Carbide Corporation
270 Park Avenue, New York 17, N. Y.

UNION CARBIDE

For more facts Circle No. 173 on Welding Info-Aid Card

YOU GET MORE

with a

miller

GOLD STAR SR

. . . Much more! More and better welds in less time, for one thing. You buy the welder just once . . . but every minute it's in use, it's bearing big interest in the form of increased production. More welder life too: Better basic design combines with Miller's own selenium rectifier to deliver performance, reliability and rectifier durability never approached elsewhere. And more economy too? Yes, especially more economy. That's why motor generator sets – even new ones – are being replaced daily with Miller Gold Star SR welders.

Write for descriptive literature on the Miller Gold Star SR, or see your local Miller dealer for a demonstration on the how and the why of the "More You Get With a Miller." He proves it! Also available upon request is a new and interesting pamphlet "Rectifiers for Welding" – which you should have.

miller ELECTRIC MANUFACTURING COMPANY • APPLETON • WISCONSIN

EXPORT OFFICE: 3 West 57th Street, New York 19, N.Y. • Distributed in Canada by Canadian Liquid Air Co., Ltd., Montreal

Our purpose: to define, describe and promote the use of welding and its allied processes in every production and maintenance activity to all phases of industry and business.

A degree of discontent

DIFFERENT MONTHS have special meanings for me. In November, naturally, my thoughts turn to Thanksgiving. Most of us have many things for which to be thankful. And yet, some of us are reluctant to acknowledge this fact.

We would all probably be more thankful if the world was not so full of hotheads ready to blow this planet to bits, if our daily pace did not sometimes make life a rat race, and if there were not quite so many engineers, architects and others reluctant to use welding.

But if conditions were serene and simple, there would probably be little need for a Thanksgiving Day. A degree of discontent is needed to keep us striving for better things.

Most of mankind's advances are results of constructive discontent. Dissatisfaction causes changes, and often, changes spell progress. The degree of progress, however, depends on whether our discontent is constructive or destructive.

Those who think Thanksgiving Day has no meaning unless everything in the world is rosy should reflect on how this day came into being. In the words of one of the Pilgrims:

"We crossed the wide and perilous sea for liberty of conscience and here we have found it. We left the old home to gain release from persecution and here we are free. Everything we sought we have. It is time for thanks and not for doleful complaint."

Thanksgiving Day was the aftermath of trials, tribulations and tragedy, and these three usually are the forerunners of better things.

Let us hope the trials, tribulations and tragedies of these times foreshadow better, greater and more peaceful days.

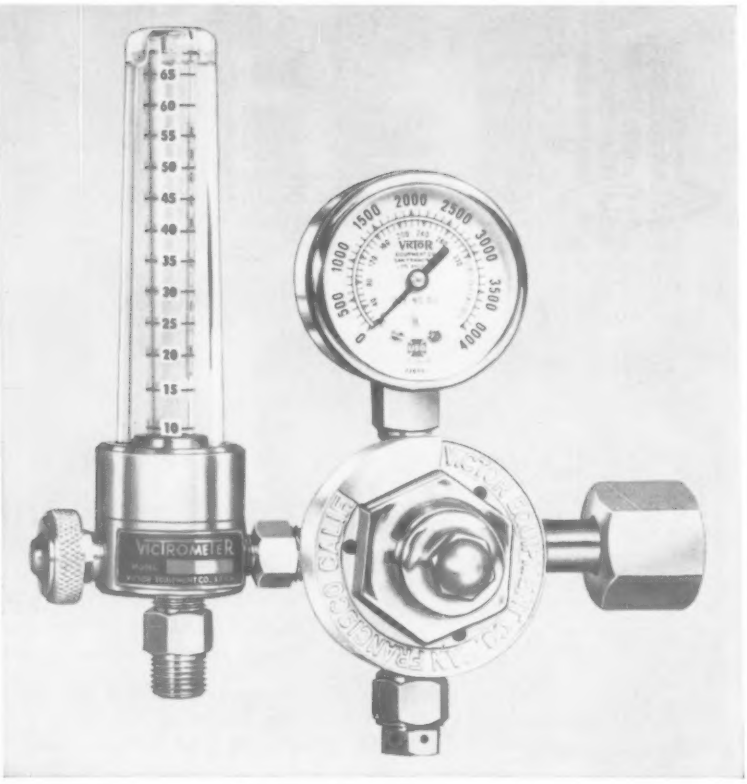
VICTOR

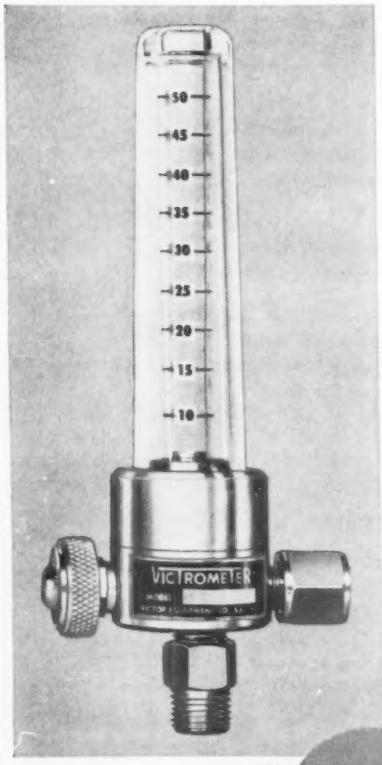
REGULATORS & VICTROMETERS

control and measure

argon • helium
nitrogen • hydrogen
carbon dioxide • air
dissociated ammonia

Especially suited for gas shielded arc welding and laboratory work





COMBINATION TWO-STAGE REGULATOR-VICTROMETER

For applications requiring constant delivery flow over a range of decreasing cylinder pressure.

COMBINATION SINGLE-STAGE REGULATOR-VICTROMETER

For applications where a slight delivery flow increase due to decreasing cylinder pressure is not an important factor.

VICTROMETER

Models for use on regulators or distribution line stations.

Non-compensated type operates on a range of inlet pressures of 10 to 100 psi for a variety of applications where back pressure is not a factor.

Compensated type (50 psi) used with pre-set regulators and distribution lines accurately set at 50 psi. Constant pressure offsets back pressure from the outlet line.

Design features. Choice of 3 flow ranges for each gas, also combinations — argon/helium on same tube. Simple design permits quick change of tube and float for different gases and flows, plus ease of service. Tube and indicator float visible from all sides. Accurate adjustment with finger-tip controlled needle valve.

Thousands of Victor regulators and Victrometers are now in everyday use. For full details, including flow ranges for all gases listed, see your Victor dealer, or write us for Bulletin RV-2.

77

Mfrs. of high pressure and large volume gas regulators; welding and cutting equipment; hardfacing rods; blasting nozzles; cobalt and tungsten castings; straight-line and shape cutting machines; roller and idler rebuilding machines.

VICTOR
for regulators
for flowmeters

VICTOR EQUIPMENT COMPANY

844 Folsom Street, San Francisco 7

3821 Santa Fe Ave., Los Angeles 58 • 1145 E. 76th St., Chicago 19

In outer space . . .

Super vacuum causes metal evaporation, cold welding

METAL SURFACE contaminants, the bane of earth-bound weldors, would be very welcome in outer space.

According to researchers at Hughes Aircraft Co., Culver City, Calif., the super vacuum of space causes metal evaporation. Thus, entire sections of a space vehicle might disappear; grease and other lubricants would vaporize; metals in contact with each other would then cold weld.

In their metal evaporation studies, the researchers found that this phenomenon of cold welding, due to molecular attraction, occurs after evaporation of layers of adsorbed gases and impurities which coat all materials in atmosphere.

Previous studies showed that when metal surfaces are cleaned in air they are still covered by an oxide film, water vapor and other contaminants. Most experiments on metal friction are not made on metallic surfaces, but on a metal coated with this surface film. Thus, any lubricant used is considered superimposed on the contaminant film.

In the experiments, two pieces of cold-rolled steel were machined into a pointed rod and base (*see photo*) and placed in a vacuum chamber. To de-gas the specimen completely, rod end and base were heated to 1,652 F in a vacuum, then cooled to room temperature.

The rod was then lowered to the base and moved across it—but only with great difficulty—and in a short distance, complete seizure occured. When a lifting solenoid pulled the rod free, calculations showed tensile strength at the junction to be approximately 45,000 psi, nearly equal to the bulk strength of the metal rod.

About half-hour after degassing, such cold welding could no longer be made since even at the low chamber pressure, sufficient gas is present to reform a contaminating film. The vacuum of space, however, is quite different from simulation chambers.

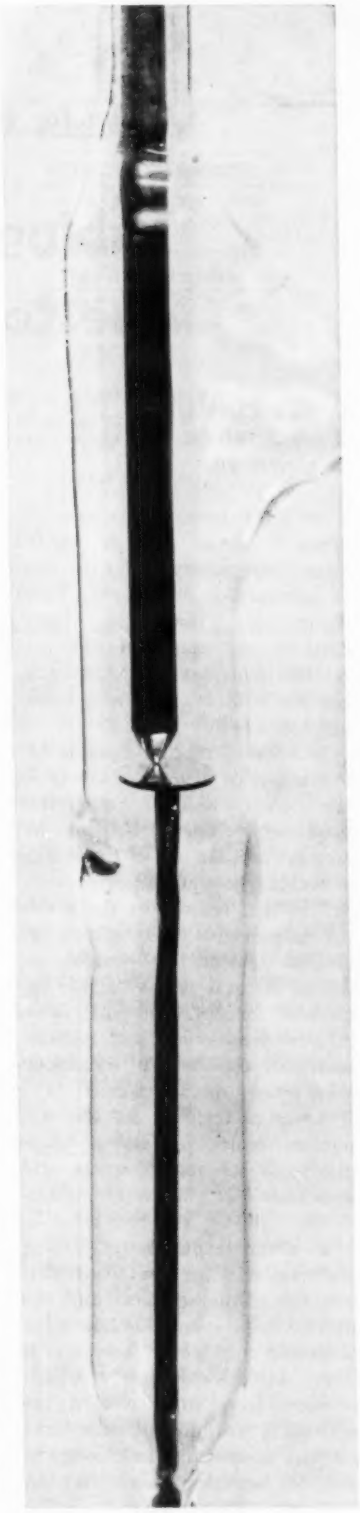
Not only is the pressure far less, but there is no obstruction in the path of molecules which leave a surface. As a result, surfaces become progressively cleaner and enhanced by increases in temperature.

Most susceptible to evaporation are cadmium, zinc and certain magnesium alloys. Iron and steel are highly resistant, while titanium, tungsten and platinum are considered best.

To prevent seizure in space, a lubricating film must be maintained on bearing surfaces throughout the vehicle's life.

Some techniques which show promise: using low vapor pressure greases to slow evaporation; using materials such as teflon which do not require lubricants and will not seize; using solid film lubricants such as molybdenum disulfide; maintaining surface pressures and temperatures at levels hindering vaporization.

Other tests have shown certain anodic coatings can reduce evaporation rates as much as 70 times. Gold plating was also found to be effective.



COLD-ROLLED and machined steel rod and base readily cold welded in space-like vacuum. Tensile strength nearly equaled bulk strength of the metal rod.

Design for welding . . .

Tubing uses grow due to appearance and strength

by Rex Cleveland
Kewanee Mach. & Conveyor Co.
Kewanee, Ill.

THE PAST DECADE has seen increased tubular use in welded structures, principally in the field of automotive equipment. Farm equipment, road machinery, earthmoving manufacturers and related fields have turned to tubing for both framing and working members.

More and more tubing is being used for frame members in the construction of production machinery. There is also increased tubular use in the design of welding jigs and fixtures.

Principal reason for the growing popularity of tubing is its favorable strength-to-weight ratio. A natural result of this increased acceptance has been greater production and reduced costs—which, in turn, will mean even more tubular usage.

A secondary, but no less important, reason for tubing's popularity is its attractiveness and appearance of massive strength.

Two basic types of steel tubing are available for use in welded structures—the seamless and the welded-seam types. Because of a favorable cost factor, however, it is the welded-seam tubing which is most frequently selected for structural framing, beams and support members. Most common uses for seamless tubing are in bearings, sleeves, hollow shafts, wheel hubs or axles, etc.

Tubing selection, like that of any structural member, should be based on application requirements and on the suitability of available sections. Mechanical properties of a given section, tubular or otherwise, are unaffected by either material used or method of manufacture.

A 2-in. square tube with an 11-gage (0.120-in.) wall thickness has a moment of inertia of 0.5338 and a gyration radius of 0.7691, whether made of C-1008 or AISI-8640, and whether roll-formed and seam welded from hot-rolled pickled strip, or cold-finished and mandrel-drawn seamless. The same is true of all other sections. Shape and material distribution are the factors which determine suitability of a tubular section for a specific job.

If a structural member is to be used in tension, the old formula of S=F/A (Strength=Force divided by Area) will determine its usefulness.

Used in compression, the same formula applies—except in the case of very long compression members. These must be treated separately and are subject to special formulae due to the danger of buckling. Columns of great length must be treated as beams, as must any compression or tension member which may be subjected to side loading.

Tubing which may absorb side loading (such as a lever), must be selected by application of a beam formula. These are found in any engineering handbook along with diagrammatic illustrations showing application.

Ability of a section to resist bending determines its usefulness as a beam or lever. This property is expressed as the moment of inertia of the section, and is based roughly upon the area of that part of the section farthest from its center multiplied by the square of its distance from the center.

In the tubular line, those sections best suited as beams or levers are the rectangular types when used with the long dimension of the section absorbing the load. Next best would be oval sections, then squares, with round sections last.

Which section to use as a beam or lever would also depend on whether side loads were to be encountered, or whether the member might be subjected to torsional loads. A rectangular section will not handle much side loading or twisting. A square tube would handle side load well, but at a loss of beam capacity, and it would not offer much resistance to twisting. An oval section would be good as a beam where torsional loads were also involved.

Should an application be one of pure torsion, or torsion with only slight beam or side loading, the choice would always be a round tubular section. Round tubes are not worth much as beams, at least in proportion to their cross-sectional area. Pound for pound, however, they are unsurpassed as torsional members. Shear load problems can usually be solved by using torsion formulae and basing section strength on its radius of gyration property.

Selection of tubular sections for tension members is strictly a matter of which shape is most desired to fit a space or to match other shapes in the same structure, since cross-sectional area alone is the factor which deter-

mines section strength.

Picking a tubular section to be used as a beam is more complex. Unless a specific shape is predetermined by taste, or necessity of matching other structural sections, the choice would have to be the rectangular section.

In any case, choice of section must be based on requirements of the member. This is determined by computing bending moment—the load multiplied by its distance from the support, expressed in inch-pounds or foot-pounds. This, in turn, sets up the moment of inertia requirement for the section to be used, and permits an intelligent first choice.

TUBE BENDING RULES

WITH MANDREL	WITHOUT MANDREL
In same plane, must start 1½ x OD apart.	In same plane, must start 1 x OD apart.
In different planes, must start 2½ x OD apart.	In different planes, must start 3 x OD apart.
Must start 1 x OD plus 0.01 x radius of bend from tube end.	Must start 1¼ x OD from the tube end to prevent end distortion.

Note: (1) Bends with mandrel can be made with a radius of 1½ x OD and up, depending on wall thickness and OD.

(2) Length of tubing required to make a bend is:

$$L = \frac{2\pi rd}{360^\circ}$$

where L=length; r=radius of bend; d=degree of bend.

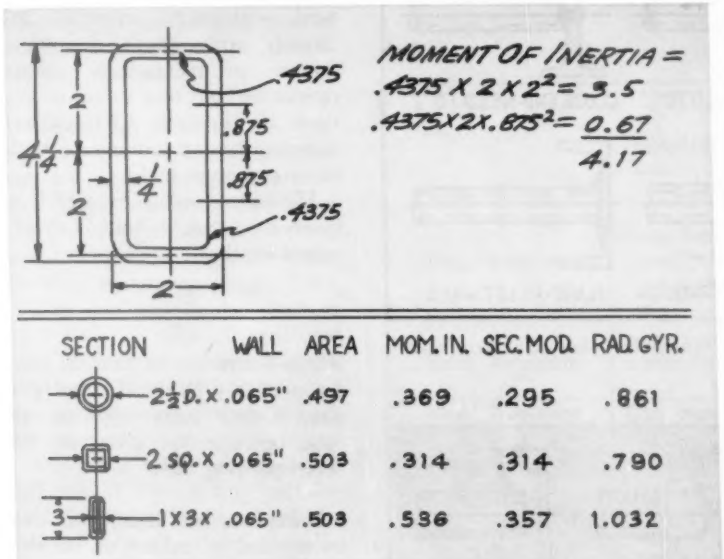
Selection of proper torsional sections is made in the same manner, except that the torsional moment must be calculated and used in combination with the radius of gyration property of the section to be used.

The round tube is the most versatile, at least for multi-purpose applications. A square tube having the same OD and wall thickness will excel for all but torsional applications.

A rectangular tube will serve as a one-direction beam, but will fail as a torsional member. The oval tube is strong torsionally, but weak as a beam in proportion to cross-sectional area.

With section determined, strength of material must now be combined with it to determine its actual usefulness. The known properties of mild steel (C-1008 to C-1030) are the basic guide to section strengths.

All that must be known, in addition, is that yield strength in each case is about 50% of ultimate strength. It is yield strength that must be used for design purposes, less allowances for abusive loading, etc., which will cut these figures in half again. Frankly speaking, the only safe figures to use are approximately 25% of ultimate strengths.

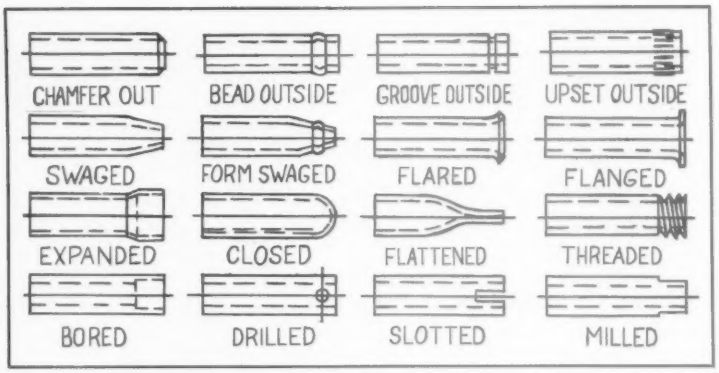


TOP: An illustration of the meaning and determination of the moment of inertia of a rectangular tube. BOTTOM: Comparison of the properties of round, square and rectangular tubes of approximately the same wall thickness and cross-sectional areas.

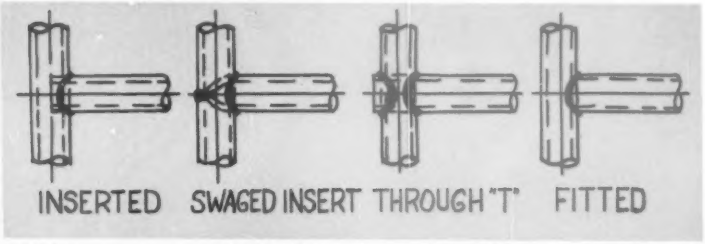
Fabrication problems differ with each tubing shape or section. In all cases, the first important step to consider is cut-off.

All tubing can be cut by hack saw, circular saw or abrasive wheel. Saw cuts leave a burr both inside and outside the tube which usually must be removed before the piece can be used. Cut-off in a press also is possible for all tubing shapes, but the die dents the tube inward on one side in the process, and the end is deformed.

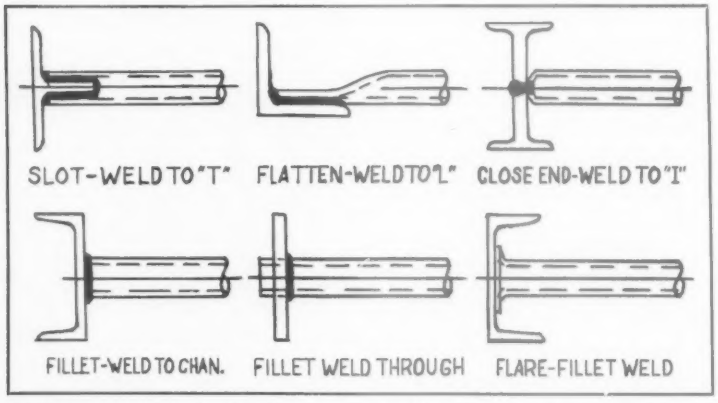
Round tubing can be cut in a lathe, leaving only a slight burr both inside and outside, and the



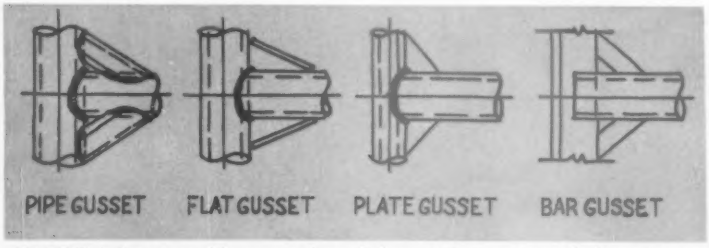
END treatments of round tubing commonly used for joining and other functional purposes.



MOST common methods of joining and welding round tubing to tubing at 90-deg or near 90-deg angles.



SEVERAL methods of joining round tubing to other structural members at 90-deg or near 90-deg angles.



ANGLE joints in tubing may be reinforced for greater rigidity by any of these four methods.

latter can be removed by a chamfering tool as part of the cut-off operation. Round tubing also can be cut on a disc-type pipe or tube cutter. This method rolls the tube inward on the end, forming an inside burr that is difficult to remove.

For square, oval or rectangular tubing, saw cut-off is best. All angle cuts must be made with saw or press, regardless of tubing shape.

All tubular shapes can be bent, but only with proper equipment. Trying to bend tubing without proper equipment produces flattening, wrinkling and general distortion.

Proper bending equipment consists of close-fitting rolls or dies moving on a radius equal to the centerline of the tubing bend. These dies contain the tubing as it is being bent, preventing wrinkling and flattening. Where extremely good bending with minimal tube distortion is required, a mandrel slightly smaller than tube ID is drawn through it as the tube is bent.

Round and oval tubing can be bent without a mandrel, although with some distortion. Square or rectangular tubing cannot be bent to a radius of less than 10 times its OD without dimpling and collapsing of both inner and outer walls.

Minimum radius to which a given tube can be bent is determined by the formula:

$$L=\frac{2468\P(D^2-d^2)}{g}$$

where L=radius of bend at centerline, D=OD, d=ID, and g=gage. Other rules applying to tube bending are given in the accompanying box.

Numerous end treatments can be applied to tubing of various shapes. All can be performed on round tubing, most of them on oval and square tubing, and some on rectangular tubes. Some of the treatments are required for joining or fastening, some for ap-

pearance. All are expensive, and should only be used when absolutely necessary.

Joining or fastening tubing to tubing, or to other members, presents special problems. Tubing to be joined end-to-end is best done with a chamfered-end fillet weld, providing the weld cross-section is equal to wall thickness of the tube

Selection of any of the common methods of joining tubing to tubing at an angle depends on application. Obviously, if a tube is to be used to carry liquid or gas, it cannot be obstructed inside, and edges must be carefully drilled or flame-cut before fit-up and welding.

No matter which method is used, the weld must duplicate tubing thickness in cross-section. Each joint type must be considered on its own merits. The preferred method, all cost considerations aside, would be the fitted joint, for it will distribute loads most evenly, and does not require the weakening of either tube.

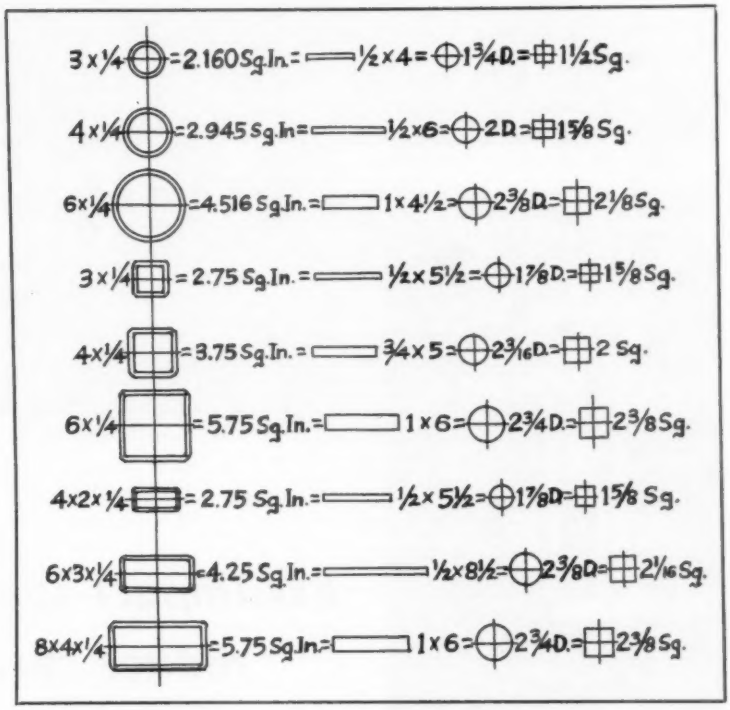
Joining tubing to members other than tubing can be done by innumerable methods, a few of which are shown in the accompanying sketch.

Almost any structure now using bar or structural sections can be made stronger, more rigid, more attractive and more massive in appearance by conversion to tubing of the same cross-sectional area.

This can usually be done at very little increase in cost and with no increase in weight. Such structures will sell better, last longer, and bring customers back for more.

Designing with tubing is not difficult. If there is any trick involved, it would be simply to "think tubing" when planning the structure, frame or working member involved.

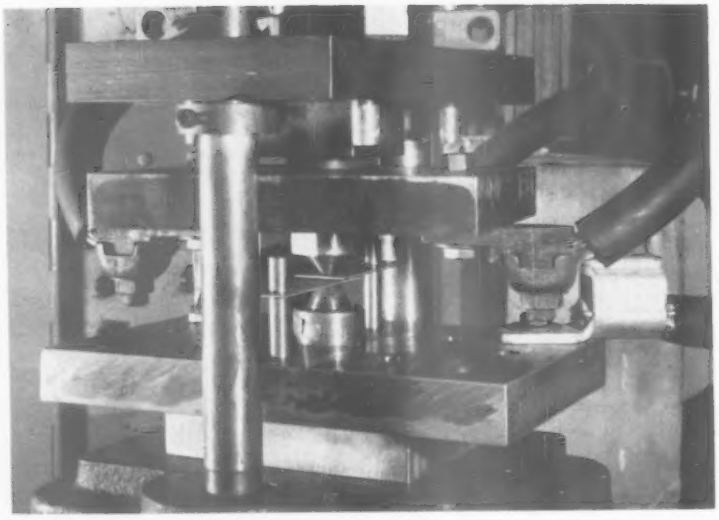
(For a reprint of this article, circle number 248 on the Welding Info-Aid Card, page 87.)

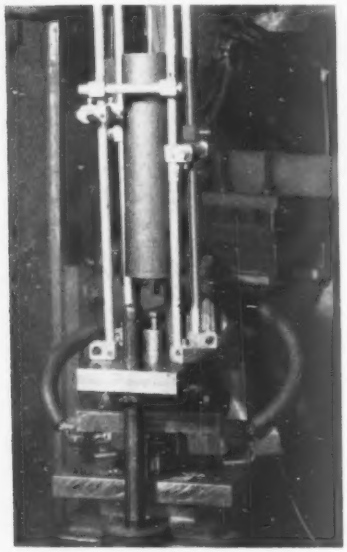


COMPARISON of common tubular shapes and sizes with bar sections of approximately the same cross-sectional area illustrates the appearance of massive strength and actual increase in section properties inherent in tubular sections.

	SEAMLESS TUBING	WELDED-SEAM
Shapes Available	Round only	Round, oval, square, rectangular
Alloys Available	Made from most alloys available in other shapes	Mild carbon steel only: approx. C-1008 to C-1030
Finishes Available	Hot- or cold-rolled	Hot- or cold-rolled
Sizes Available	Large variety of close-tolerance decimal sizes	Limited, and decimal sizes not promoted or maintained
Heat Treatment	Can usually be done	Uncommon
Machining	None needed	Outer weld flash removed; inner flash removal optional
Structural Uses	Almost none, due to cost approx. 1.3 x that of welded tubing	Framing, beams, supports
How to Order	By ID or OD & wall thickness	By OD and BW gage (except for some larger sizes)

IMPACT spot welder test set-up is shown in overall view (below) with weight and alignment rods. Close-up at right shows electrodes and two 0.045-in. mild steel sheets in position for welding.





RW: Impact-spot method can reduce machine weight

BECAUSE A RESISTANCE welding machine must serve as a press, in addition to its primary current-conducting function, weight and mass of the cantilever arms on many machines have long been a problem for designers and users alike.

In an independent effort to reduce the weight-mass situation for spot welding machine arms, the welding research specialists of Armour Research Foundation recently conducted experiments utilizing a dropped weight to provide electrode forging force on lap welds.

Since lap welds can be created by solid-phase bonding (cold welding) as well as by resistance welding, the ARF welding personnel set out to study both processes. Aluminum was selected for the cold welding investigation, mild steel for the resistance welding portion of the study.

ARF's test set-up for cold welding was essentially an alignment device with two opposed punches or dies. Most of the work was done with a rectangular die face (0.062 in. by 0.375 in.) that gave better results than a circular face. Workpieces were clamped to reduce distortion.

Two types of force were applied to the dies to create solid-phase bonds: (1) static force provided by a standard testing machine, and (2) the impact of a 21-lb weight falling free from a height of 18 in.

The researchers noted that both loading methods gave approximately the same per cent of reduction-strength relationship. The impact method of force application, therefore, was convenient, but didn't offer any advantage in terms of improved weld properties.

Regardless of loading method, however, reduction in section thickness at the weld was so great —almost 100% in some instances —that many welds were almost punched holes. The cold weld tests were discontinued because they obviously lacked commercial interest.

ARF's resistance welding tests were conducted entirely with impact loading. Equipment was similar to that for cold welding experiments, except that electrodes were substituted for punch dies, and were connected to the secondary of a spot welding machine.

Electrodes were copper alloy types machined to a truncated cone shape with a welding surface diameter of ¼ in. They differed from ordinary dies only in the fact that their major diameter was larger than usual to better withstand the impact of the falling weight.

Current applied to the welds was approximately 6,000 amp for 60 cycles, but two different heating combinations were tested. In one instance, specimens were welded with only 5 to 10 cycles of preheat current before impact. Another group of specimens received 35 to 45 cycles of

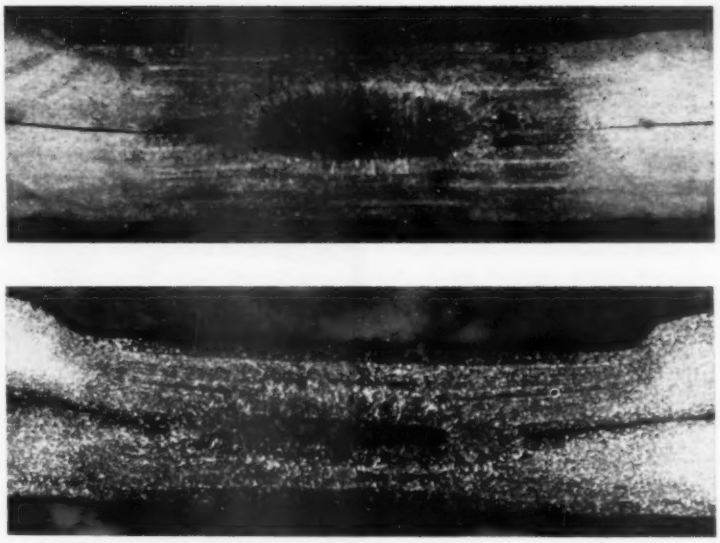
preheat current before impact. In both cases, remaining cycles of current were applied during and after welding.

The accompanying photos show examples of both specimen groups. The low-preheat sample shows a fairly good weld nugget, normal heat-affected zone, and minimal reduction in section thickness at the weld.

The high-preheat sample, on the other hand, has a considerably smaller weld nugget because some liquid metal was expelled on impact. It also has an extensive heat-affected zone, and a greater weld indentation. Both samples were 0.045-in.-thick mild steel.

Only in two instances did the test personnel vary the height from which the 21-lb weight was dropped; in each case, the weight was dropped from double the normal 18-in. height.

The amount of time that force actually was applied to the spot welds (less than one cycle) was not studied by the ARF group, but they feel that in further tests this impact "dwell time" might be deliberately increased by inserting an energy-storing device between the ram and the electrode. Such a device might be a spring, or an air cushion.



TOP: Cross-section of mild steel impact lap weld made with low preheat (5-10 cycles). ABOVE: Specimen received longer preheat (35-45 cycles). Some molten metal was expelled from latter joint on impact.

Other conclusions drawn by ARF's welding research group:

1. Lap weld strengths measured in tension shear were comparable for both static and impact loading.

2. Important conditions for impact resistance spot welding include (*a*) those which control workpiece temperature at time of impact; (*b*) those controlling the time in which the ram force is applied, and (*c*) those which control post-impact heating.

3. A variation (not investigated) might involve an air hammer to create multiple impacts which could (*a*) increase over-all time of force application, and (*b*) create pre-impact electrical contact by bringing sheets together and disrupting surface scale.

4. Size of resistance spot welding equipment can be appreciably reduced.

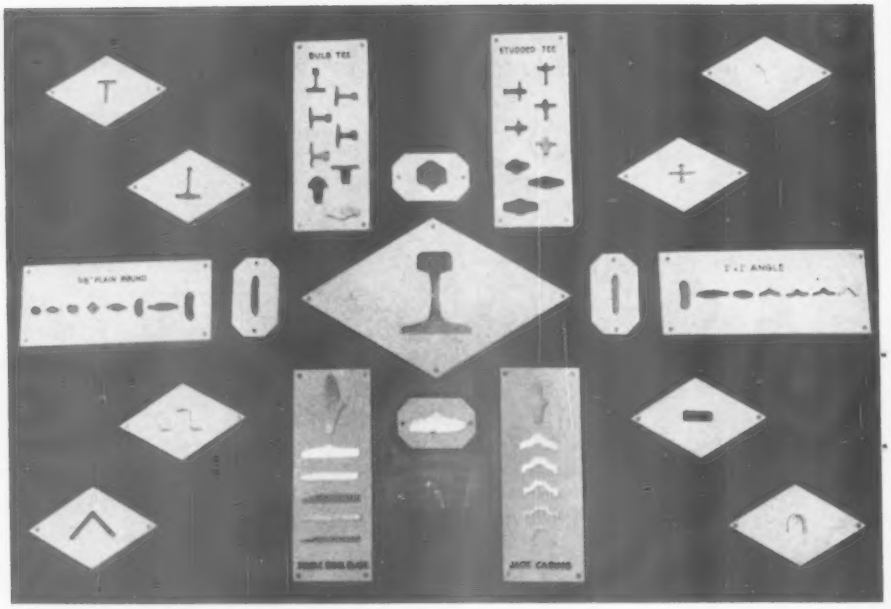
Test results of impact resistance welding

Specimen No.	Drop Height (in.)	Current Time (1/60 sec)	Preheat Time (1/60 sec)	Current Setting (%)	Current Magnitude (rms amps)	Tensile Shear Strength (lb)
1	18	30	-	40	not recorded	low
2	18	30	-	50	not recorded	low
3	18	30	-	60	not recorded	low
4	18	30	-	50	3300	low
5	18	60	35	50	3150	660
6	18	60	0	50	3000	250
7	18	60	7	50	3000	500
8	18	60	8	50	3100	480
9	18	60	17	60	4000	880
10	18	60	4	80	5950	1220
11	18	60	39	80	6600	≥ 1220
12	36	60	13	40	2000	105
13	36	60	33	40	2050	400
18	18	60	5-10	50	not recorded	sectioned
19	18	60	35-45	50	not recorded	sectioned
Fig. 1	18	60	5-10	80	not recorded	sectioned
Fig. 2	18	60	35-45	80	not recorded	sectioned
Recommended**	-	-	-	-	10,000	1100 min.

NOTE: All samples, 0.045 in. mild steel.
**: "Resistance Welding Manual," Vol. 1, p. 124.

University study shows . . .

RAIL STEEL CAN BE WELDED EASILY



by **Norman R. Braton** and **Donald Roeber**

FROM RAILROAD TRACK to farm machinery — this is a typical conversion for the hundreds of tons of rails removed from service each year.

How is rail steel made; why is it different; what welding techniques are recommended?

Rail steel is railroad track, heated and reshaped. A rail in good condition, but worn below a usable rail tolerance, is first sent to one of 12 rerolling mills located throughout the United States and Canada.

After thorough inspection, the 39-ft standard rail lengths are cut to more workable 10-ft and 9-ft lengths. These are then heated to approximately 2,000 F and forced through a splitting head which separates them into head, web and flange.

While still hot, the three parts are passed through a series of rolls for desired shaping, *e.g.*, flats, angles, rounds, bulb tees, blades. (*See photo above.*) After shaping, the sections are cut to desired lengths and sent to manufacturers of such final products as farm implements.

A high percentage of this rail steel is also used in manufacturing fence posts, cow stanchions, hay forks, auto jacks and similar items.

Rail steel has about twice the tensile strength of common low-carbon steels, yet sells in the same price range, making it a much better buy when strength is a necessity.

Its superior strength and hardness are due to the large amounts of carbon and manganese (*see table on page* 50).

As many weldors have proved, rail steel can be welded successfully. Tests sponsored by the Rail Steel Bar Association at the University of Wisconsin also bear this out. However, current belief in welding circles can be summed up by this statement from the Welding Handbook:

The welding of steel containing carbon in greater amounts than 0.30% usually involves the use of special welding techniques (preheat and postheat) in order to obtain sound welds with required mechanical properties.

Undoubtedly such warnings were necessary before welding qualification, close inspection, proper training and low hydrogen electrodes became integral parts of arc welding.

A report by Armour Research Foundation on the arc welding of rail steel now states:

Rail steel, and similar high-carbon steels . . . can be welded with high heat input rates and with good degree of success without the precaution of preheat and stress relief. The static and dynamic strength and the ductility of such weldments are quite satisfactory for many applications.

Studies by the University of Wisconsin's mechcanical engineering department further bear out the theories that rail steel, with carbon content up to 0.80%, can be successfully welded without preheat or postheat.

The study also showed that to maintain high tensile strength and good machinability of high-carbon steel welds, many of the suspected variables have little, if any, adverse effects.

Successful welds were made with various wind velocities, limited input welders, temperatures from —8 to +70 F, a wide range of amperages, and a wide variety of electrodes and machines.

Low hydrogen electrodes improved weld quality by reducing hydrogen embrittlement. But conventional electrodes also proved adequate (*see photo on page* 50).

Messrs. Braton and Roeber are connected with the mechanical engineering department, University of Wisconsin.

RAIL STEEL WELDING TECHNIQUES

What makes up good welding techniques in high carbon steels? Close adherence to the following points are most important.

1—Proper current setting. Use an amperage recommended by the electrode manufacturer on the electrode container. For high-carbon steel perhaps the amperage setting should be near the top of the recommended range.

2—Proper arc length. Arc length should be held as short as possible to maintain an efficient arc, one that operates smoothly, and places the heat and the metal deposit where needed.

3—Proper angle of electrode. The angle of the electrode when welding high carbon steels is generally more vertical than for lower carbon steels. In this way, hot molten metals are given better protection from the surrounding atmosphere.

4—Proper travel speed. As in all welding, the weldor should not move forward any faster than at a speed where satisfactory fusion is obtained. Likewise, he must move fast enough so that molten metal does not icicle.

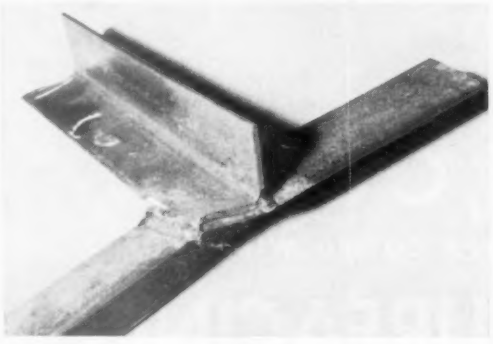


PHOTO 1

5—Proper electrode selection. Trade name, of an electrode makes little or no difference. First, determine the strength of the filler metal desired, by selecting an electrode with an AWS or ASTM code of E60XX, E70XX or up to E120XX. The E70XX series has been found desirable for welding most farm machinery and open web structures for buildings.

A second point in electrode selection is the last two digits. An EXX16 or and EXX18 is usually considered good for welding high carbon steels. The EXX16 is a low-hydrogen type and has a special lime coating baked at high temperature for a longer period than the conventional electrode, and then placed in a hermetically sealed container. They must be kept sealed until used.

When the seal is broken, only a two-hour supply should be removed. The remainder must be placed in a heated oven at a temperature

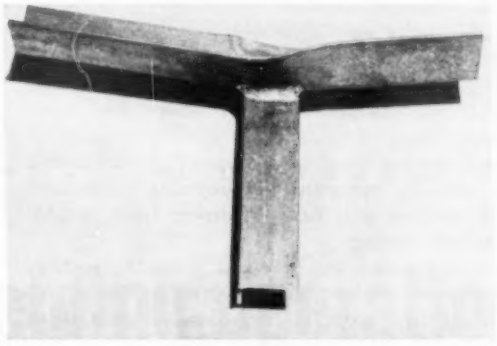


PHOTO 2

(usually 350 F) recommended by the manufacturer. The EXX18 is also a low-hydrogen electrode but with an iron powder coating which provides easy arc starting and good metal transfer across the arc.

6—Proper arc striking. Wherever possible the arc should not be struck on the base metal, but on a striking pad. Striking an arc on metal, regardless of how fast, weakens the metal at that point. If a strike pad is not feasible, then strike the arc on the parent metal ½ in. in from the edge, but in the line of weld. Then go back to the outer edge, properly position the electrode and proceed back over the area where the arc was first struck.

7—When feasible, make a traverse weld in preference to a side weld. Tests have shown that traverse welds are approximately 30% stronger (see photos 1 and 2).

8—Use run-off pads. Whenever feasible use a scrap pad to end your weld. This eliminates attempting to fill the crater at the weldment end, which usually results in porosity and slag inclusion. When run-off pads are inconvenient, the next best technique is to hold your electrode in a vertical position, shorten your arc and then attempt to fill the crater.

Steel	Carbon	Manganese	Phosphorus	Tin	Tensile strength
Rerolled rail	0.80	0.84	0.016	0.030	100,000 to 150,000 psi
Low carbon	0.20	0.45	0.040	0.050	40,000 to 60,000 psi

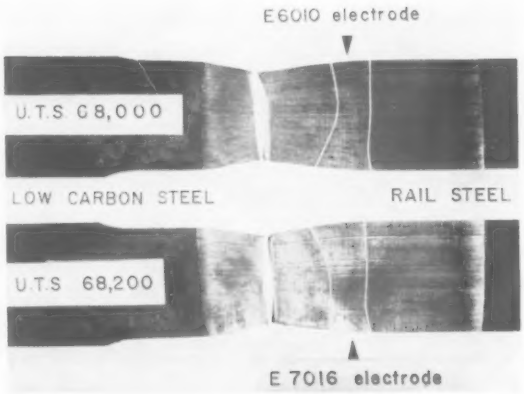
The photograph proves that apprehension in welding low-carbon steel to high-carbon steel also is unfounded. The two lines on the welding specimen enclose the weld zone between low-carbon and rail steel. The break occurred in the low-carbon steel, not in the weld zone, indicating adequate weld strength.

According to Dr. Charles Keel, director of the Swiss Welding Society:

High quality welding is only possible where full reliance can be placed on sound construction design, the proper selection of materials, correct stress calculations, efficient shop appliances, proper shop preparation, meticulously accurate execution of shop work, periodic examination of welding operators, appropriate preheating and thermal post heat treatment, and suitable materials testing.

Though preheat and postheat have been found unnecessary for certain properties or given sizes, "meticulously accurate execution of shop work" perhaps best spells out success in welding rail steel.

There is no substitute for proper weld technique in obtaining adequate rail steel welds. In addition, stringent weldor qualification and intelligently



alert inspectors are needed. (*See boxed material.*)

In conclusion, these studies show great strengths can be attained when welding high carbon steels, up to approximately ¼-in. thick, without preheat or postheat, providing proper welding techniques are used, qualified weldors are employed and adequate inspection by qualified personnel is practiced.

(*For a reprint of this article, circle number* 249 *on the Welding Info-Aid Card, page* 87.)

Ranomatic A, BX, C and D
ARE TUBULAR TYPE COILED WIRES FOR
HARD SURFACING
BY THE AUTOMATIC OR SEMI-AUTOMATIC PROCESSES
COMPOSITIONS OF DEPOSITS MADE BY THEM ARE COMPARABLE TO THOSE MADE FROM THE TIME-TESTED
RANITES A, BX, C AND D STICK ROD
SOLD THROUGH YOUR LOCAL DISTRIBUTOR
RANKIN MANUFACTURING COMPANY
616 SOUTH MARENGO AVENUE • P. O. BOX 631 • ALHAMBRA, CALIFORNIA

SEE HOW PAGE PROVIDES THE

SELECTION
PACKAGING
SERVICE
INVENTORY CONTROL

to improve your welding operations

You can get just the right wire for your welding operations from PAGE. Because we offer a choice of 33 analyses—the largest selection in the industry—wires are available for practically any job. And when a particularly *tough* welding problem exists, PAGE can often develop a special wire to solve it.

From single coils to 1200-lb. Payoff-pallets, PAGE can supply the packaging that offers you the greatest convenience in handling, storage and use. You can specify the packaging that meets *your* requirements.

Nationwide service helps you meet your welding needs quickly and efficiently. A coast-to-coast network of distributors, backed by strategically located warehouses, assures prompt delivery.

Typical color-coded label for reels—as grades of wires change, so do colors

Cartons, spools, Payoffpaks and Leverpaks included in PAGE color-coded packaging

Simplified inventory and reduced scrap loss are the results of PAGE's new color-coding program. For the first time, you can purchase *all* your automatic welding wire with permanent, color-coded identification. What's more, each color-coded label shows complete data on grade, size, heat number, weight and order number.

In all these ways, PAGE can help improve the quality of your welding operations, reduce your costs, simplify your stocking and handling. PAGE welding specialists are available to give expert advice. That's why it makes sense to bring your welding problems to PAGE.

***Write** for information on the complete line of PAGE welding wire. **Folders DH-402** and **DH-1218** list PAGE analyses, describe packaging, include most competitive makes. New color-coding identification card available.*

PAGE
PAGE

WELDING WIRE

Page Steel and Wire Division • American Chain & Cable Company, Inc.
Monessen, Pa.*, Atlanta, Chicago (Melrose Park)*, Denver*, Detroit, Houston*, Los Angeles* New York, Philadelphia*, Portland, Ore., San Francisco*, Bridgeport, Conn. *Indicates PAGE warehouse stocks

ACCO TRADE MARK

—the source for answers to welding problems

Upside-down Tig welding maintains uniform pipe contour

by F. T. Tancula . . . *Editor*

OVERHEAD WELDING usually is to be avoided. But Trent Tube Co., East Troy, Wis., puts overhead — or more precisely in this case, upside down — welding to advantage.

Tubing is formed with seam on the bottom and the weld is made by the Tig process, with the tungsten electrode making the continuous weld upside down.

Trent, which claims to have been the first to Tig weld stainless tubing commercially, calls the patented process Contour Trentweld. In conventional downhand welding of tube, gravity pulls some of the molten metal down into the pipe to form a bead. Cold working becomes difficult. But by flopping the tubing, Trent makes the inner weld contour correspond to the contour of the pipe wall itself.

In addition, welding with the electrode upside down prevents inclusion and contamination from the tungsten.

Trent, a subsidiary of Crucible Steel Co., was founded almost 20 years ago. Spokesmen for the firm attribute a great deal of its success to the fact that the company started as engineers of weld-

At Trent Tube, the air-conditioned X-ray facility houses a General Electric OX-175 unit.

In photo at right, eight lengths of 1.315-in. OD, type 304 stainless steel tubing are being inspected. Wall thickness is 0.109 in. Using 14 by 17 in. Kodak AA film sheets at 30-in. focal film distance, with 0.005-in. lead screens back and front, 15-in. segments of the eight tubes are radiographed at one time, with 140 kvp at 30 seconds.

Maximum output of the unit on a continuous duty cycle is 12 ma — used when inspecting the more exotic metals like Zircaloy 1 and 2.

Controls are in a lead-lined booth, which is also contained in the X-ray room. Leonard Bolin is the X-ray technician pictured in this photo.

The fixture and the raising and lowering mechanism were designed and engineered by Trent. For ease of inspection, the X-ray tube head moves up and down — note the cone-type shield.

Now in the development stage are new ideas which may effect considerable savings in set up time and radiographic materials.

• For improved MIG welding to 200 amperes...

GLENN CV200

Single-Phase

Constant-Voltage DC Power Supply

Model CV200 is only 19" wide x 25½" deep x 31" high; weighs 375 lbs.

Under development and field testing for the past 1½ years, the GLENN CV200 Single Phase power supply offers the finest performance available today in MIG power supplies of comparable rating.

Exclusive GLENN circuitry (patent pending) is designed especially to provide the correct volt-ampere slope for gas-shielded, wire-fed arc welding — including the entire range of short arc welding and spray-arc up to 200 amperes.

Other advantages include:

- **SINGLE-PHASE INPUT at 230 or 460v — no costly special wiring required.**
- **LOW INPUT — only 17 amp at 460v or 34 amp at 230, at full rated load.**
- **SIMPLIFIED CONTROL — set the desired voltage on the vernier dial and you're ready to weld. Balanced constant-voltage circuit automatically provides correct volt-ampere slope for MIG welding at its best.**

Rated output is 200 amps at 30 vdc, 100% duty cycle. Open circuit output voltage range is 8.5 to 53 on 230/460v input.

Because of its compactness, low initial cost and ease of installation, the GLENN CV200 makes the benefits of MIG welding practical and possible for many new applications. Why not get the facts **now**? Write today for literature, prices.

GLENN PACIFIC
CORPORATION
INDUSTRIAL POWER SUPPLIES
703 - 37th AVENUE • OAKLAND 1, CALIFORNIA
MID-WEST OFFICE: 644 South York • Elmhurst, Illinois
EASTERN OFFICE: 615 Riverwood Avenue • Point Pleasant, New Jersey

7

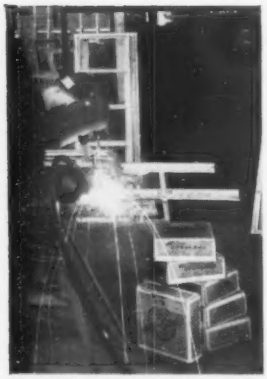
For more facts Circle No. 178 on Welding Info-Aid Card

For more facts Circle No. 179 on Welding Info-Aid Card

SPOOLED WIRE

USE **SPOOLARC®**

for porosity-free welds...
constant arc...better control
...fewer errors...faster work



Rapid fabrication of aluminum window frames by metal inert-gas welding requires trouble free aluminum wire. Philadelphia manufacturer increased his production with mirror-finish All-State SPOOLARC®

Wire internally inspected by RADAC

Aluminum wire in all tempers now available in mirror finish, oil-free, precision layer wound spools. ALL-STATE's cleaning and tension controlled winding method produces wire free from helix (twist), permitting welds that do not walk.

Aluminum SPOOLARC® is packaged with desiccant in sealed plastic bags to eliminate moisture, a common cause of porosity in welds.

OTHER METALS—silicon bronze, deoxidized copper, aluminum bronze, phosphor bronze, magnesium, and nickel. Available in SPOOLARC® form. For more information on SPOOLARC® and other ALL-STATE products, send for free 56-page Instruction Manual and SPOOLARC® literature.

Available from distributors everywhere.

All-State

ALL-STATE WELDING ALLOYS CO., INC.
White Plains, N.Y. Dial 914 WH 8-4646
QUALITY WITH SERVICE

TRUMPF

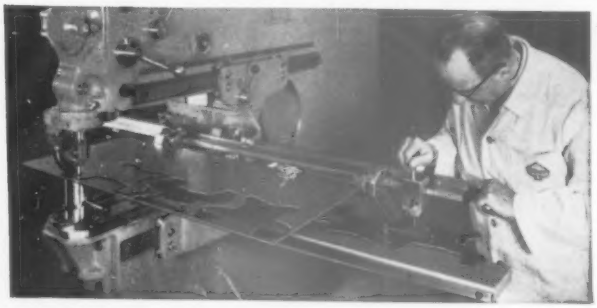
"COPY NIBBLERS"

mass produce any shape

...Copy directly from your master

Quickly—Easily—Economically does

- *Beading*
- *Folding*
- *Shearing*
- *Slotting*
- *Flanging*
- *Louver Cutting*



Eliminate high tooling costs:

Sheetmetal is firmly clamped and guided by roller-bearing coordinates as operator effortlessly feeds tracer along template contours. Built-in rulers quickly position sheet for rectangular cuts. Circular cuts to 24" diameter are made through a special swivel ruler.

All-side-cutting punch pierces its own starting hole—cuts in any direction without distortion. Copy nibbles up to 9 gage steel—regular nibbling up to 0.20" steel—shears up to ¼" steel.

Steplessly adjustable stroke and stroke position. Three models—throat depths 41", 49" and 59". Universal forming attachments available.

Demonstrations arranged with Factory Specialists.

COSA

Importers of Leading Precision Machine Tools
Nationwide Sales and Service
COSA CORPORATION, 405 LEXINGTON AVENUE, NEW YORK 17, N.Y.

ing equipment. Today, it produces a wide range of stainless, titanium, zirconium and other special alloy tubing in diameters from ¼ in. to 40 in. OD. The bulk of its output is stainless tubing of the 300 series.

A typical production pattern for stainless — in this case 4-in. OD, 0.120-in. wall, type 304 — includes:

1. **Forming** the tubular product on the mill from flat strip.

2. **Welding** the butted joints upside down by the Tig method. Thoriated and pure tungsten electrodes are used, depending on product type and grade being manufactured. Power sources are standard transformers, as well as rectifier and motor generator units. Helium or argon, or a mixture of both, are used as the shielding gases.

3. **Cold working.** Trent uses both cold drawing and rotary swaging. Diameter and wall thickness are reduced with tolerances of 0.001-in. OD, plus or minus, maintained.

Cold working adds to the yield strength, hardness and tensile strength of the tube. With subsequent annealing, it also modifies the grain structure of the weldment, heightening its corrosion resistance.

4. **Annealing** in a gas-fired furnace. Temperature range for stainless steel tubing is 1,900 to 2,000 F. Annealing is followed by quick quench which prevents carbide precipitation.

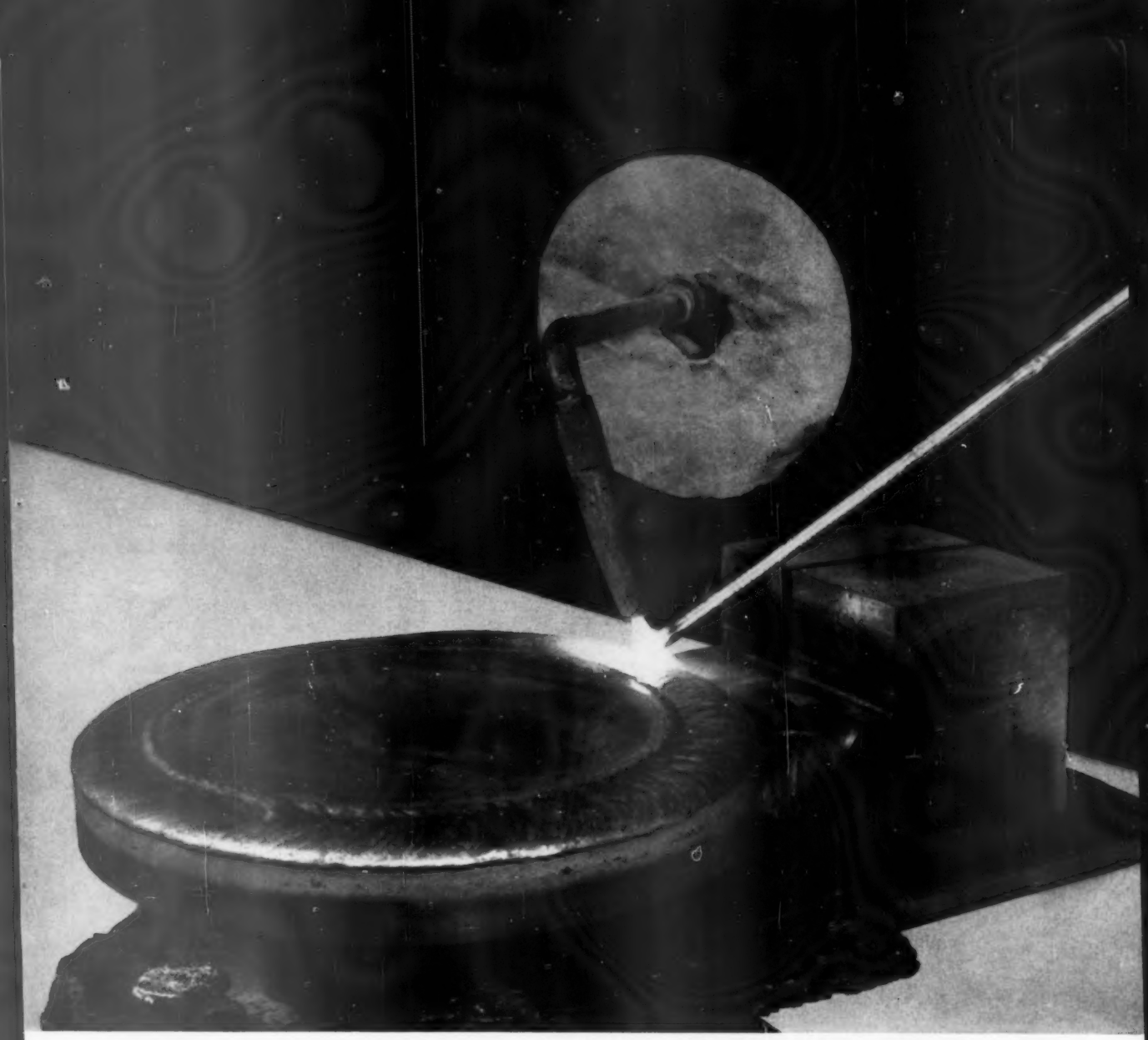
5. **Machine straightening.**

6. **Descaling.** Pickling and passivating baths insure removal of mill scale or free iron that may have been picked up during processing.

7. **Cutting** to length.

8. **Inspection** (*see box*). In addition to X-ray inspection, Trent uses hydrostatic test procedures and eddy current testing. On special jobs, ultrasonic testing may be employed.

For more facts Circle No. 180 on Welding Info-Aid Card



HAYNES STELLITE cobalt-base alloy is used to hard-face this 8 in. valve disk used in nuclear equipment.

Hard-Facing?

There's a
HAYNES Alloy
for the Job!

This 8-in. valve disk is being readied for rough service. It will soon be subjected to heat, abrasion, galling and erosion while handling radioactive water and steam.

It must operate properly . . . and for long periods. That is why the manufacturer has specified that its seating surface be protected with HAYNES STELLITE alloy No. 6. This cobalt-base alloy will withstand the severe service conditions . . . and the deposit can be machined to provide a perfect metal-to-metal seal.

HAYNES alloys can solve *your* metal wear problems, too. They provide exceptional resistance, can be applied to almost every metal, and are available as powders, bare rods, electrodes, tube rods, and coils. You can deposit them by any welding process . . . manual or semi-automatic. Write for full details.

HAYNES
ALLOYS

HAYNES STELLITE COMPANY
Division of Union Carbide Corporation
Kokomo, Indiana

UNION CARBIDE

Address inquiries to Haynes Stellite Company, 270 Park Avenue, New York 17, N.Y.

The terms "Haynes," "Haynes Stellite," and "Union Carbide" are registered trade marks of Union Carbide Corporation.

For more facts Circle No. 181 on Welding Info-Aid Card

Torch Brazing with GB Silver Brazing Alloys and GB #88 Flux assures freedom from failures!

Operators from coast to coast recommend the joining of Brass, Copper, Steel, Stainless Steel, Monel, Inconel, Silver and Gold *with the increasingly popular GB Silver Brazing Alloys and GB #88 Flux.* Quality control in manufacturing, dependable results in use, and real economy add up to complete satisfaction in producing strong, leak-proof joining of metals.

GB Silver Brazing Alloys are available in the size and shape *you* require . . . in all popular diameters, in coils, straight lengths, pre-formed rings and special shapes. *All* GB alloys meet *all* Standard Specifications.

GB #88 Flux, known for its low glare and low fuming qualities, is available in 3 oz. jars, ½ lb, 1 lb and 5 lbs, and 25 to 50 lb drums.

Complete data is available by return mail.

Goldsmith Bros.
DIVISION OF NATIONAL LEAD CO.

900 West 18th Street, Chicago 8, Illinois • Branches in principal cities

Metal uses, welding techniques covered at AWS fall meeting

WELDING WILL BE a $2 billion industry by 1970, despite current sluggishness of industry in general. So stated AWS President A. F. Chouinard at the society's fall meeting.

Basis: although '60 was disappointing to steel and related industries, welding sales exceeded 1959 by some $75 million.

Among the papers presented at the recent Dallas meeting:

¶ Titanium alloy is the newest addition to submarine hull metals. Crack-free Mig welds in 120,000 psi yield, 2-in.-thick alloy plate were produced; Battelle Memorial Institute.

¶ Electron-beam welds compared to Tig dry-box welds in various materials. EB does not enhance weld strength in conventional materials, but can weld a low-alloy, hardenable steel in the final heat-treated condition at high strength levels when necessary. Joint efficiency is 20% higher than Tig, however, when welding refractory metals; Allison Div., General Motors Corp.

¶ Tensile joint efficiencies of 100% were achieved on full-hard, 301 stainless using Mig and sub-zero cold working; Watertown Arsenal Labs and Manufacturing Laboratories, Inc.

¶ Weld puddles stirred electromagnetically improve weld deposits, and may be significant when applied to alloys prone to hot-cracking or segregation; Armour Research Foundation.

¶ Preplaced, thin nickel-beryllium sheet helps make joints with high shear strength in variety of high temperature alloys; Westinghouse Electric Corp.

¶ Titanium can be Tig welded to low-carbon steel and resistance welded to austenitic stainless, if a third material (vanadium) is used in the joint; Titanium Metals Corp.

For more facts Circle No. 182 on Welding Info-Aid Card

For more facts Circle No. 183 on Welding Info-Aid Card →

There **is** better service available in CO_2

LIQUID CO_2 Prompt and reliable CO_2 delivery is only part of the service ThermIce offers you. Each ThermIce trailer is designed to serve as an emergency standby CO_2 tank, should your own equipment or supply source fail you. Every trailer carries its own generator and pumps and can supply either liquid or vapor CO_2 directly into your process line.

DRY ICE The large fleet of new and modern ThermIce trucks at every depot assures prompt service, especially for those unscheduled "emergency" requirements caused by sudden weather changes or public utility failures. • ThermIce trucks carry extra heavy insulation to minimize sublimation. ThermIce dry ice is delivered to you at maximum size, with clean, square edges, eliminating waste in repackaging operations. • ThermIce offers *reliable* dry ice service. Every depot manager is a specialist in routing and scheduling delivery to meet your particular needs.

Subsidiary of **PUBLICKER INDUSTRIES INC.**

1429 Walnut Street, Philadelphia 2, Pa.

Philadelphia—DEwey 4-7255
New York—COrtlandt 7-8533
Jersey City—SWarthmore 8-2233
Washington, D. C.—ENterprise 1-3553

Baltimore—PEabody 2-3550
Boston—ANdrew 8-5250
Chicago—KEnwood 6-2244

Cleveland—VUlcan 3-4166
Cincinnati—621-9605
Detroit—Vinewood 2-8868
St. Louis—PRospect 6-0860

Columbium-steel pipeline offers

✓weldability
✓strength
✓economy

A 47-mile natural gas line gives evidence on success of XC-60 steel

"THE STRONGEST and probably the freest of weld defects of any natural gas transmission line ever built."

This statement, by A. G. Barkow, superintendent of inspection for Natural Gas Pipe-Co. of America, underlines the success of a recent 2-year, $1.5 million program to develop XC-60, a new columbium-additive steel.

The project was sponsored jointly by Natural Gas Pipeline Co. of America, Great Lakes Steel Corp. and A. O. Smith Corp.

The main advantages claimed for XC-60 are:

1 — All-weather field weldability.

2 — High strength levels permitting thinner-wall pipe and steel tonnage savings.

3 — Resulting substantial cost savings.

A field-welded 47-mile, 20-in.-diameter gas line of the steel produced an estimated $1,000-per-mile saving compared to costs for X-52 grade pipe steels. Girth-welding the columbium-additive steel cost about $1,100 per mile compared to $1,200 per mile for X-52.

This comparison did not consider the additional factor that X-52 may require preheating, upping per-mile costs by $500 or more.

Although the initial cost of the columbium-additive steel is higher than other standard pipeline steels, XC-60 still proved to be more economical because:

1 — Steel requirements for the pipeline were reduced — about 12% fewer tons per mile.

2 — Field welding and material handling costs were lower.

3 — Since less metal was required, freight costs were lower.

The 47-mile line required 6,580 tons of pipe fabricated in 0.250-in.-thick plate to attain pipe wall strength of 60,000 psi minimum yield.

The columbium-additive steel pipe proved easily weldable with standard equipment and methods from room temperature down to -25 F, without preheat.

Field welding tests were conducted at the pipeline construction site using both manual metal-arc and submerged-arc welding.

For manual welding, E6010 electrodes were used on root (1/8 or 5/32 in. diameters) and cover passes (3/16 in.). On the second and third passes, 5/32 and/or 3/16-in.-diameter E7010 electrodes were used. Current for root passes was 180 amp at 28 volts while that for remaining passes was 200 amp at 30 volts.

For automatic submerged arc welding, wire and flux conformed to E7010 deposit specifications.

First pass was made at 90 ipm, using 800 amp at 36 volts; second pass, 65 ipm, 700 amp at 32 volts; inside pass, 50 ipm, 500 amp at 34 volts.

Radiographic inspection of the finished pipeline's field welds proved them to be crack-free

As a result of information gained from this project, the outstanding difference in weldability between XC-60 and X-52 steels was found to be the greater fluidity of the welding puddle in the columbium-additive steel.

Another important conclusion was that if XC-60 is handled like mild steel, it can be welded without trouble and danger of cracking.

This new fine-grain columbium steel achieves its higher strength levels through a lower carbon-manganese chemistry. XC-60 is about 30% lower in carbon and 25-35% lower in manganese than the highest strength pipe steels now in general use, according to National Gas Pipeline Co.'s report.

The use of columbium was decided upon because, as an additive to steel, it has a strong affinity to carbon and acts as a ferrite former on the crystalline structure of the steel.

This ferrite action forms a fine grain structure increasing yield and tensile properties.

NEW LIFE FOR OLD GOGGLES

Exclusive replacement face pads extend B&L cup goggle life indefinitely

Face pad dirty or worn? Don't throw the goggle away—and don't offend workers by keeping it around. Just snap out the old pad, snap in a new one.

Standardize on these safe, comfortable, durable Bausch & Lomb chippers and welders goggles with the exclusive B&L replaceable face pad. Four snap fasteners are imbedded firmly in the sponge rubber pad. You simply snap new replacements into place in the goggle eyecups. They always fit securely.

You extend your goggle budget because you can buy fewer basic goggles, and "renew" them with replacement pads. You insure worker comfort, encourage cleanliness and care. For details on the complete line, call your supplier, or write: Bausch & Lomb Incorporated, 98723 Lomb Park, Rochester 2, New York.

BAUSCH & LOMB
SINCE B&L 1853

Protection PLUS Safety Products

protection + economy + worker acceptance

For more facts Circle No. 184 on Welding Info-Aid Card

600,000 pounds of ATOM·ARC® * helped create a welded waterfall at Niagara

The rushing waters of the Niagara River, diverted through this man made waterfall are energizing one of the world's largest hydroelectric power plants . . . The Niagara Power Project of the New York Power Authority. The project consists of two generating stations, the Niagara Generating Station and the Tuscarora Pump-Generating Station with a combined capacity of 2,190,000 kw.

Chicago Bridge & Iron Company constructed the project's 25 penstocks and also erected the 25 turbine scroll cases. This huge field construction job required in excess of 600,000 pounds of Atom·Arc iron powder low hydrogen electrodes.

Atom·Arc and the *Creative Craftsmanship* of CB&I is a combination that has worked together on many jobs such as this throughout the world, compiling an enviable record of success.

Here are some of the *job proven values* that have helped spell success for CB&I and other discerning fabricators: X-ray sound weld metal . . . excellent impact values . . . outstanding arc characteristics . . . plus a complete line, in strength levels from 70,000 psi to 120,000 psi and in analyses for welding nearly every type of low alloy high tensile steel.

To find out how these *job proven values* of Atom·Arc electrodes fit into your welding needs, send for our 64-page booklet, "Handbook for Welding Low Alloy High Tensile Steels." Write to Alloy Rods Company, Post Office Box 1828, York, Pennsylvania.

ALLOY RODS COMPANY

YORK, PENNSYLVANIA

SALES OFFICES AND WAREHOUSES • BOSTON • NEWARK • PHILADELPHIA • PITTSBURGH • BIRMINGHAM
CHICAGO • CLEVELAND • SAN FRANCISCO • EL SEGUNDO, CAL. • DISTRIBUTORS IN ALL OTHER PRINCIPAL CITIES

Thirteen penstocks, each 28 feet in diameter and 460 feet long, and at the far right, the scroll case installations which make up the Niagara Generating Station.

* **ATOM·ARC®** is the trade name for America's first and foremost iron powder low hydrogen electrode.

Left—Weldor joins flange to copper piping using Tig torch and 1/8-in.-diameter copper filler rod. Weld is made in two passes using helium as shielding gas. Below—Worker measures distance between pipes used in the heating, air-conditioning and ventilating system for $15 million hospital.

Tig welded copper piping provides heating, ventilation for Missouri hospital

ALL-WELDED COPPER piping in lengths of more than 1,000 ft. each will furnish heating, air-conditioning and ventilation for a new, 11-story hospital in St. Louis County, Mo.

Ranging from 5 to 10 in. in diameter, the Tig welded pipe will travel from a separate power house through underground tunnels to the $15 million St. John's Hospital.

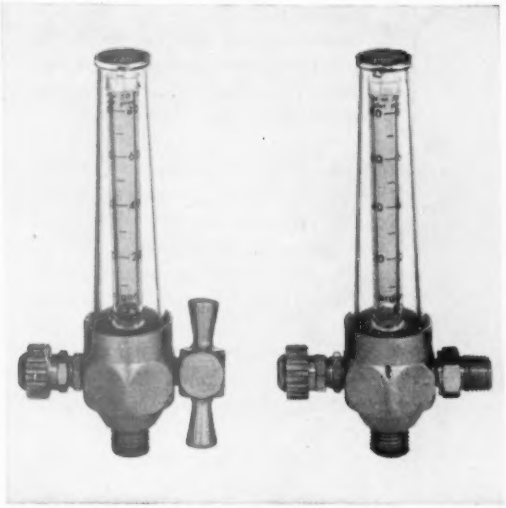
Located in the power plant will be two 660-ton centrifugal refrigeration units, three 30,000 lb/hr high pressure steam boilers and related equipment.

The air-conditioning system will provide individually-controlled temperatures for each of 500 rooms, including surgery and administration. Under present plans, the system will also be connected to a six-story combined nurses' home and training school with 300 additional rooms, and an adjoining gymnasium- auditorium. The hospital itself will later be expanded to include an additional 100 rooms.

All welding on the copper piping was done on the job site. However, a certain amount of 2½ in. to 18 in. diameter steel pipe was also required for the installation, and most of this was manual metal-arc welded with E6010 electrodes in the contractor's welding shop.

According to Louis Cardwell, project engineer for Natkin & Co., St. Louis, the heating and ventilation contractors, the copper pipe was first beveled and cleaned with a wire wheel, and then properly spaced. After flux was applied, the pipe was preheated to approximately 500 F. Using ⅛-in.-diameter RCu welding rod as filler, the piping was then Tig welded in two passes. Power source was a 300 amp motor generator unit.

Working from both ends of the



this new flowmeter offers many advantages. it can be easily converted for use with any cylinder gas and all required flow volumes

If YOU use primarily CO_2 and only occasionally other gases, such as Helium, Argon or Nitrogen, the interchangeability of the calibrated pyrex tube can limit your flowmeter inventory and your flowmeter investment. All you need to stock are the properly calibrated pyrex tubes which are easily installed, without special tools, by removing the flowmeter outer shell . . .

THE NEW FLOWMETER IS PRESSURE COMPENSATED AT 50 p.s.i.g. inlet pressure AND CAN BE FURNISHED WITH SINGLE OR TWO STAGE REDUCTION REGULATOR FOR ANY CYLINDER GASES.

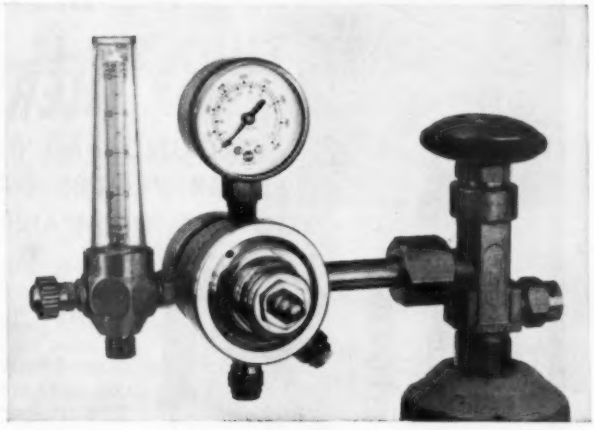
Where delivery pressure accuracy and a minimum of freezing is important the two stage reduction regulator is recommended.

THE FLOWMETER CAN BE FURNISHED WITH ANY REQUIRED INLET FITTING SPECIFIED BY THE PURCHASER.

We can furnish the flowmeter with any type of inlet connection specified. Since the calibrated pyrex tube can be turned in any desired position, the flowmeter will accommodate right hand, left hand or rear entrance. "O" ring construction assures gas tight joints and simplifies pyrex tube exchange or positioning.

WE CAN FURNISH EITHER SINGLE OR TWO STAGE REDUCTION REGULATORS.

The new flowmeter may be furnished attached to either a single or two stage reduction regulator preset to a delivery pressure of 50 p.s.i.g. . . . For industrial use the regulators are brass finished; for medical use both flowmeter and the regulator are highly chrome plated. All NATIONAL of CALIFORNIA regulators are made of solid bar stock for long and safe service life and interchangeability of assembly parts.



LITERATURE BY REQUEST

NATIONAL welding equipment company...

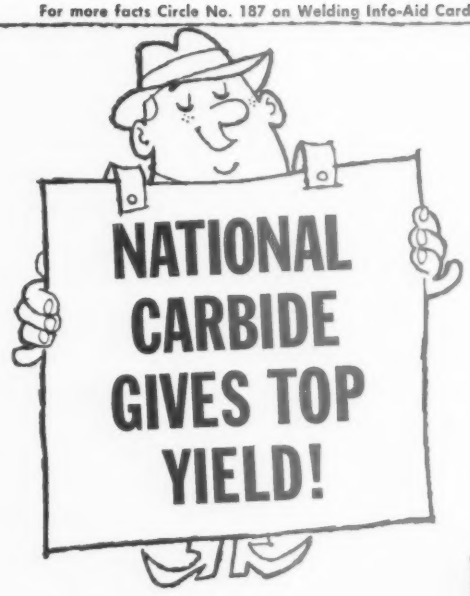
218 fremont street san francisco 5 california

AD NO. 576A

National 50 ... of ... california

For more facts Circle No. 186 on Welding Info-Aid Card

For more facts Circle No. 187 on Welding Info-Aid Card



All you want—when you want it in the **RED DRUM.**
All sizes, in quantities from 2 lb. pkgs. to 5 ton hoppers.

Calcium carbide is a product of:

AIR REDUCTION CHEMICAL & CARBIDE CO.
A Division of Air Reduction Company, Incorporated
150 East 42nd St., New York 17, New York, MUrray Hill 2-6700 area code 212

WELDERS--YOUR EYES DESERVE THE BEST!

ONLY THERMO
GROUND and POLISHED
FILTER PLATES CAN GIVE
YOU 100% UNIMPAIRED VISION

There is no substitute for a Thermo Optically Ground and Polished Filter Plate which is carefully graded and selected to insure you a sharp definition and eliminate fatigue.

The restful soft green shade gives you maximum reduction of eye strain.

Always protect your Thermo Filter Plate with a Sta-Kleer All-Plastic long-life cover lens.

THERMACOTE Company
108 SOUTH DE LACEY AVENUE • PASADENA, CALIF.

tunnel, specially built four-wheel trucks carried the Tig torch, its water coolant circulating system, the electric leads and the cylinder of shielding gas.

At first, when welding 10-in. brass to copper, the power source was operated on 480 volts using argon as the shielding gas. However, the welding unit became overloaded and poor welds resulted.

To correct the situation, the shielding gas was changed to helium; the welder could then be operated at 250 amp with sufficient heat to make a good weld. Argon and helium consumption was 28 cu. ft. per 10-in. pipe joint — each pass running 31.4 in., the circumference of the pipe.

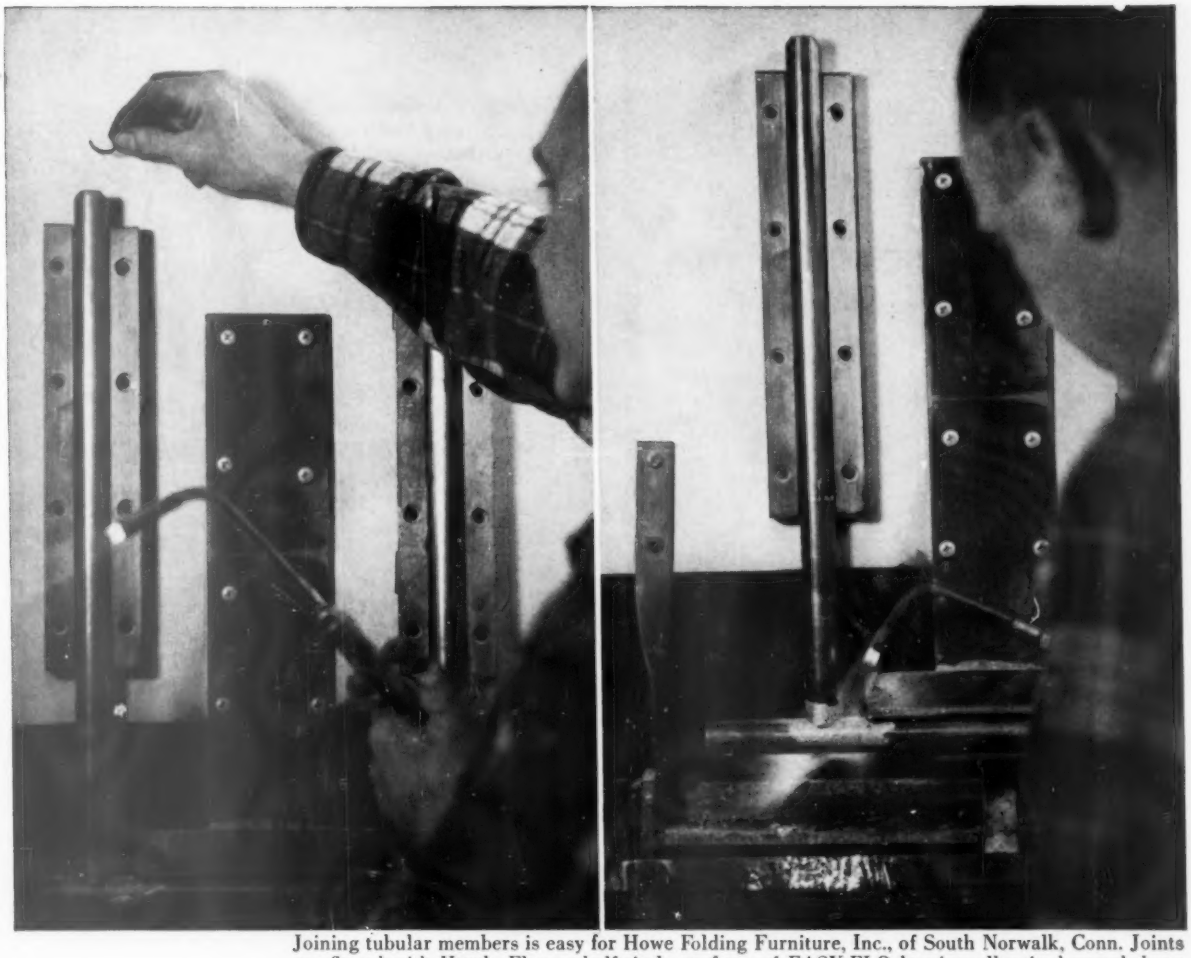
All copper pipe, as well as small diameter steel pipe, was cut with an abrasive wheel, while the large diameter steel pipe was flame-cut.

A total of four man-hours (including weldor and helper) per joint, using 1½ lb. of welding rod, was required. The only post-weld treatment was cleaning of the weld with a wire wheel. Finish welds were tested under 150 lb. hydrostatic pressure and each weld was hammered.

This marks the fourth location for the hospital since its beginning in 1871 in the center of St. Louis. The new hospital on its 123 acre site stands on an elevation offering a view of the countryside from every hospital room. The present hospital in St. Louis has been in use since 1912.

When completed in the fall of 1963, St. John's Hospital will be the largest Catholic hospital west of the Mississippi.

Architect for the project is Bernard McMahon; consulting engineers, Delaney, Sheldon & Associates, Inc.; Trane Co., La Crosse, Wis., built the air-conditioning system; and general contractors are C. Rallo Contracting Co. and J. S. Alberici. All copper piping for the hospital's ventilation system was supplied by Lewis-Mathes Co., St. Louis.



Joining tubular members is easy for Howe Folding Furniture, Inc., of South Norwalk, Conn. Joints are fluxed with Handy Flux, a half-circle preform of EASY-FLO brazing alloy is dropped down the tube and a torch is applied. Result: A smooth, strong joint quickly and economically made.

How Handy & Harman Brazing Alloys

GIVE FOLDING FURNITURE 100% JOINT RELIABILITY

The experience of Howe Folding Furniture, Inc., with silver brazing merits close attention if your operations involve metal-to-metal joining of any kind. Howe manufactures folding metal tables and seats for commercial, industrial and institutional use. You can imagine the hard usage the furniture has to take—yet survive indefinitely.

Some years ago, it was Howe's practice to purchase prefabricated steel tubular assemblies in which the joints were brass brazed on the outside surface. To improve their product, Howe thoroughly tested all joining methods, and decided to go over to silver brazing in their own plant, using Handy & Harman EASY-FLO Alloys 45 and 35. Look at the results:

Complete Joint Reliability: Since adopting silver brazing, Howe has completely eliminated the problem of broken joints.

Economy: Silver brazing costs Howe less than other methods, requires less heating time, simpler equipment, much less cleaning and grinding of joints.

Appearance: Silver brazing provides a smoother, more attractive joint, that can be plated directly.

Is it any wonder Howe says: "We'd stay with silver brazing even if it cost more." There are few fields of industrial activity where the strength, high production rates and economy afforded by the Handy & Harman family of silver brazing alloys cannot improve the look of the balance sheet. Interested in complete details? Just write for a copy of our Bulletin 20 – it's packed with engineering and application data.

Howe cafeteria table-bench is converted to an auditorium bench with backrest in a single motion. Silver brazed joints easily absorb strains.

HANDY & HARMAN
850 Third Avenue, New York 22, N.Y.
PLaza 2-3400

WELDORS complete fabrication of stainless steel hangers within chain section of 400-ft. long dry process kiln at Allis-Chalmers Mfg. Co., Milwaukee. Conveying spirals support suspended chain to accelerate slurry drying.

How to weld austenitic stainless steel

by **Simon A. Greenberg**
Industrial Consultant

AUSTENITIC stainless steels can be readily welded by any of the arc, gas and resistance welding processes—provided proper precautions are taken.

These steels, next to the plain carbon steels, are probably the most commonly welded metals.

Among the welding processes most often used are manual metal-arc welding and Mig or Tig welding. (Gas, atomic hydrogen and carbon arc welding have also been used, but these are slow and less desirable.)

Joint preparation, however, is the first consideration.

If the stainless steel joint is prepared by one of the oxygen or arc cutting processes, the skin of the joint faces should be mechanically removed 1/32 to 1/8 in. in depth according to the cutting process used.

When surface cleaning prior to welding, the usual rules should be observed, including the following when mechanically cleaning:

(1) Use only clean grinding wheels.

(2) Use iron-free silica or alundum blasting grits.

(3) Use only stainless steel wire brushes.

While mechanical cleaning is preferred to acid cleaning, residual oils should be chemically removed.

The safest chemical cleaning bath is acetone followed by a warm water rinse. A dilute (25%) nitric acid pickle may also be used if the steel is not left in solution too long, and if the part is carefully rinsed.

The electrode selected for manual metal-arc welding, from a corrosion standpoint, should have an analysis approximately equal to that of the base metal. To avoid chromium-carbide precipitation, stabilized electrodes are usually used where corrosion resistance is required.

One recommendation for electrode selection when welding different types of stainless is to use:

E347 (18-8 Cb) electrodes for welding 347 and 321 steels.
E308 (19-9) electrodes for welding 304 or 308 steels.
E310 (25-20) electrodes for welding 310 steels.
E316 (18-12 Mo) electrodes for welding 316 steels.

Other combinations have been used (*e.g.,* E347 electrodes for welding 310 and 316 steels), but these can be hazardous and should first be evaluated carefully.

In manual metal-arc welding, a-c or d-c reverse polarity is used, with lime-type electrode coatings preferred for the latter current.

For multi-pass welds, all craters in the root pass should be removed by grinding. The craters in other passes should be examined closely and the cracked ones removed. Those in any passes adjacent to the base metal should also be ground out.

Unless the weld can be chipped out and welded from the second side, a backing should be used. Copper backings have proved effective in providing heat conductivity, thereby preheating the joint just ahead of the welding.

A common practice is to use Mig welding for the root pass, (*e.g.,* an EB insert for welding pipe serves both as a backing and as filler metal for the root pass).

Preheat is generally not recommended. However, for heavy sections, over 2½ to 3 in. thick, or under conditions of severe restraint, a mild preheat of about 200 or 250 F, but not more than 300 to 350 F, can be used.

Inert gas welding is commonly used to weld material up to 1 or 1½-in. thick. For thin material,

For every job . . . an Ansco X-ray product

Varied film emulsions for maximum penetrometer sensitivity . . .
Versatile packages that take the work out of film handling . . .
Your Ansco representative is a trained X-ray specialist who will render quick service on a personal basis—Another example of the extra service you get when you buy Ansco. *Ansco, Binghamton, N. Y., A Division of General Aniline & Film Corp.*

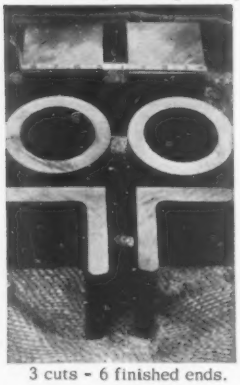
Ansco

Industrial X-ray

For more facts Circle No. 190 on Welding Info-Aid Card

WHAT'S YOUR SHOP COST PER HOUR FOR WAGES AND OVERHEAD?

If it's $6.00 you spend 10 cents per minute.
If it's $7.20 you spend 12 cents per minute.



3 cuts - 6 finished ends.

Cuts like these are made in SECONDS!

$6.00 per hour = 1/6 cents per second.

$7.20 per hour = 1/5 cents per second.

WHEN YOU CAN CUT AND FINISH LIKE THIS (Total time 58 seconds) THAT'S FAST! WHY DON'T YOU INVESTIGATE TO SEE WHAT YOU ARE MISSING.

Write and ask about "Cut-Machining."

WALLACE SUPPLIES MFG. COMPANY
1810 W. Cornelia Ave., Chicago 13, Illinois
or ***Check Item*** 191 on Card.

SPOT WELD
WITH
100% QUALITY CONTROL

CARSON DICE
Microhm Meter

Model 151 S

CHECKS surface resistance of aluminum or other sheet material — essential in maintaining weld quality. Low surface resistance shows metal is clean & should weld properly.

MEASURES resistance of coupons in test jig or of actual sheets at welder head.

TROUBLE-SHOOTS! Quickly locates abnormal resistance in electrodes, current paths, etc.

5 MICROHM RANGES: 0-75, 0-750, 0-7500, 0-75,000, 0-750,000. ACCURATE to plus/minus 2%.

Meets all applicable mil-specs. (Pays for itself in weld reject prevention.)

J. W. DICE CO.
Englewood 9, N. J. LOwell 9-0471
Circle No. 192 on Welding Info-Aid Card

TILLMAN
Gloves — Garments

PACKAGED IN POLY BAGS

3 NEW GLOVES
CARPINCHO
#770

CARPINCHO
#775

HELIARC
#24

BUY FROM YOUR DEALER

BRAZILIAN DEERSKIN
THE "STAY SOFT" LEATHER
GLOVES AND MITTENS

TILLMAN PRODUCTS
John Tillman & Co.
Long Beach, Calif.

Circle No. 193 on Welding Info-Aid Card

up to ¼-in. thick, Mig welding is often preferred over Tig.

In any case, the filler metal is chosen on the same basis as for manual metal-arc welding. Besides shielding the weld, it is good practice to purge and then continue shielding the underside of the weld when making the root pass.

The two gases most commonly used in inert gas welding are helium and argon. (See *The shielding gases — their function in the welding arc,* WE, August, page 35.)

Since arcs in helium yield more heat and therefore provide greater penetration and/or increased welding speeds, this gas is usually used for automatic, high production welding.

On the negative side, helium produces a turbulance in the arc, causing metal transfer in Mig welding to be globular and increasing spatter tendency. In addition, about three times more helium than argon is required for effective shielding, a decided drawback since helium's availability is contingent on the government's needs, being the sole producer.

Argon, on the other hand, is about 10 times as dense as helium, and in some quarters is believed to permit better arc control, especially for a-c.

Other gases have been added to helium and argon with some success. However, these gases (oxygen, hydrogen, nitrogen) have limitations:

Oxygen — Cannot be used in Tig welding because rapid wear of electrode will occur. In additions of up to 5%, it is effective in Mig welding, especially with argon. These additions improve metal transfer across the arc, giving a spray-type transfer at lower currents.

Hydrogen — Cannot be used in Mig welding because of adverse metallurgical effects. Used in Tig welding, arc potential is increased, especially with helium. However, when used with argon, hydrogen also improves weld shielding at low gas flows.

Up to 35% hydrogen has been added to argon. A 20% addition produces an arc voltage equivalent to that obtained with helium alone for the same rate of gas flow.

Nitrogen — Cannot be used in Mig welding because of metallurgical reasons. Has very limited use in Tig welding with little, if any, benefits demonstrated.

Submerged-arc welding can also be used to weld the stainless steels. However, the proper combination of wire and flux must be used. In the absence of better information, the flux and wire should be of the same brand and intended for use in combination.

Where different combinations have been used, highly unsatisfactory results have been reported. And because of its high heat input, cracking tendencies may be emphasized, especially when submerged-arc welding 347 stainless.

Stress relief is becoming standard practice in heavy welding operations, particularly for pressure vessels and piping. When stainless steels were first welded, stress relief was assumed to be necessary.

Now, however, stress relief of stainless weldments is considered unnecessary and even undesirable since such heat treatment takes the metal through the carbide precipitation, the sigma forming range and, if high enough, into the brittle metal range. (*See boxed material on page* 71.)

Recommended practice for post-heat treatment of austenitic weldments is that no stress relief be given a weld when:

(1) corrosion resistance, as welded, is adequate;

(2) high temperature strength is the primary requirement;

(3) no serious stress concentrations exist;

(4) weldments are relatively thin.

Heating to at least 1,750 F is recommended for dimensional stability, for improved corrosion resistance and for improved mechanical properties at elevated temperatures.

A preliminary 1,100 F heat

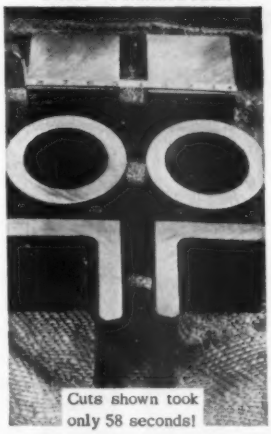
ARE YOU

WORKING OVERTIME TO KEEP YOUR PRODUCTION LINE FULL?

ARE YOU running more than one HACK OR BAND SAW?

Then you cannot afford to remain in the dark.

3 cuts - 6 finished ends.



Cuts shown took only 58 seconds!

with WALLACE "CUT-MACHINING."

YOU CAN

CHANGE MINUTES into SECONDS!

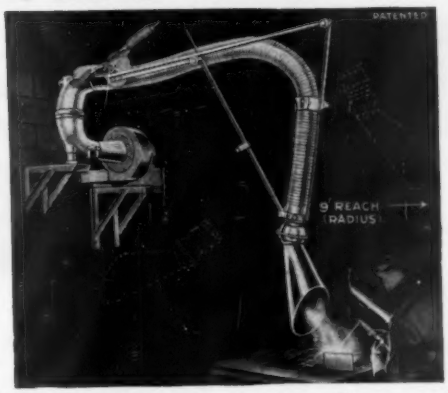
Write! Learn how it's done.

WALLACE SUPPLIES MFG. CO.
1810 W. Cornelia Ave.
Chicago 13, Illinois

or *Check Item* 191 on Card.

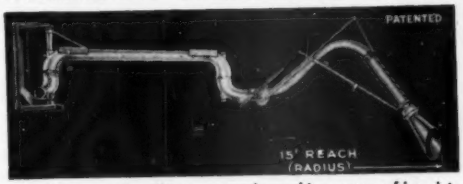
RUEMELIN Fume Collectors

Welding without ventilation. Note smoke and gas clouds.



(Right) Welding with Ruemelin Fume Collector.

REMOVE WELDING FUMES at the Source!



Ruemelin Fume Collectors remove smoke, gas and welding heat. Keep the shop air clean. Efficient and practical. Maximum coverage in welding areas. Your welders work better with this equipment in use. Write for bulletin 37-E describing the new spring-loaded counterbalance mechanism.

Long reach collector extends working range of hood to 15 ft. or 18 ft. operating radius. Double swivel permits hood to work in 360° circle for full coverage.

RUEMELIN MFG. CO.

Manufacturers and Engineers SAND BLAST AND DUST COLLECTING EQUIPMENT
3880 NORTH PALMER STREET • MILWAUKEE 12, WISCONSIN, U. S. A.

For more facts Circle No. 194 on Welding Info-Aid Card

For more facts Circle No. 195 on Welding Info-Aid Card

THE CMD®
chipping hammer
WITH
SWING BALANCE

This is the hammer with the balanced feel—swings easy, fits the hand properly, absorbs shock. *Less fatigue* and it's a pleasure to use!

CMD heads are made of ¾" square tool steel. They can be re-sharpened right down to the shaft!

Type A 20 oz., drift and right angle chisel. Type C 14 oz., drift and chisel.

TYPE A TYPE C

CHICAGO MANUFACTURING & DISTRIBUTING CO.
1928 W. 46th St. • Suite E-11 • Chicago 9, Ill.

FAST MOVING
Trindl
"JOB TESTED" ARC WELDERS
11 MODELS
80 to 400 Amps. $69.50 to $370 Complete

The most complete line of **TRINDL AC ARC WELDERS** offered in 35 years. All models from 80 to 400 Amps. Designed and engineered to meet the most exacting demands of industry. All models feature heavy duty DUAL COILS, glass insulated and VITROTEX bonded to hold the heat and stand up to roughest usage, cutting down-time to the minimum. You can change the range in seconds with the new Slanting Eye-Level Control Panel. Strong, penetrating welds assured. Every model unconditionally guaranteed for **ONE YEAR IN CONTINUOUS OPERATION.** Write Dept. T49-M

MODEL 125A
115/230 VOLTS AC
Handles rods from 1/16" to 5/32" on stock to 1/2" thick. 16 heat stages range from 20 to 125 Amps. America's finest low-priced fastest selling Welder. List price complete with all accessories only $98.50.

TRINDL PRODUCTS, Ltd.
Manufacturers of: Welders—Pipe Thawers—Welding Accessories and Supplies
1807 S. CLARK ST., CHICAGO 16, ILL.

Circle No. 196 on Welding Info-Aid Card

WE HAVE THE
FLUX RIGHT
For Your Job

65 years of experience in scientific development in welding

Whatever the particular job you have to do — we have the right FLUXINE you need. Besides our 25 FLUXINES we carry a complete line of "KOP-R-ARC" coated rods for welding copper and all copper alloys.

Write on company letterhead for chart and generous sample stating which FLUXINE desired.

KREMBS & COMPANY
(Est. 1875)
Dept. J, 669 W. Ohio St., Chicago 10, Ill.

Circle No. 197 on Welding Info-Aid Card

treatment followed by a 1,800 to 2,000 F stress relief is suggested for the 347 stainless to reduce stresses and crack susceptibility at the higher temperatures.

The ASME boiler code states that stress relief of austenitic welds is neither required nor prohibited. Therefore, if corrosion resistance is not a factor, stress relief should not be used if the undue stresses can be avoided.

Heavy stress concentrations can be avoided by locating welded joints away from points of maximum stress and by proper attachment of clips, brackets and similar stress raisers.

If stress relief is used, it should be between 1,750 and 2,000 F. (The code recommends 1,850 to 2,000 F.) Holding time at temperature should be one hour per inch of thickness, with a two hour minimum.

Extreme care should be taken to support the weldment so no part of it is unduly stressed due to expansion. Cooling should be rapid, at least about 1,000 F. (The boiler code recommends that cooling down to 1,000 F be done in three minutes.)

AWS practice recommends rapid cooling for the unstabilized grades. However, for heavy walled weldments or weldments of non-uniform section, the cooling rate should not exceed 400 F per hour divided by the wall thickness in inches. The cooling rate below 1,000 F may be reduced to about 150 F per hour.

As a compromise, a low temperature stress relief in the range of 800 to 900 F can be used to reduce peak stresses and improve dimensional stability.

When welding stainless to carbon steel, one practice is to butter the carbon steel with a stainless deposit and then make the joint as if two pieces of stainless were being welded. Another practice is to use an E310 electrode, since its 25-20 composition helps maintain chromium and nickel levels in the joint.

Stainless clad steels in thick sheets (where a vee-groove is needed) are joined by first weld-

ing the carbon steel base up to, but not including, the cladding. The weld is then chipped out and a stainless weld deposited from the clad side.

Where the sheet is thin enough to be welded in a square groove, welding can be done with a stainless electrode from the stainless side. Again, an E310 electrode is useful to compensate for dilution.

The differences in spot and seam welding stainless and carbon steels are based on the greater electrical resistance and lower heat conductivity of stainless. For example:

¶ Since stainless has an electrical resistance four to ten times greater than carbon steel, less current is used for the same metal thickness.

¶ Since the heat conductivity of stainless is ⅓ to ½ that of carbon steel, less welding time and current is required.

¶ Since stainless steels tend to retain their strength at elevated temperatures more than carbon steels, more electrode force should be used, as well as harder electrode materials.

¶ Since the shunting effect is less than that of carbon steel, spot welds in stainless can be spaced closer together.

¶ Since shorter times and less current are used, better control is desirable and synchronous precision controls should be used.

In resistance welding stainless, distortion can be a problem, so more small welds rather than a few large ones are recommended and in some cases a staggered sequence may be necessary. These same considerations apply to seam welding.

Thus, when welding stainless steel, follow the one rule basic to any welding operation: proper joint and welding procedure must be prepared and evaluated, taking into consideration the specific conditions and requirements of the application.

(*For a reprint of this article, circle number* 250 *on the Welding Info-Aid Card, page* 87.)

Carbide precipitation and sigma phase

. . . *their cause, effect and control*

One metallurgical phenomenon associated with many of the stainless steels is carbide precipitation.

When these steels are heated between 800 and 1,600 F, chromium carbides are formed and may be precipitated into the grain boundaries, depending on composition.

Depletion of chromium adjacent to the grain boundaries decreases the corrosion resistance of these steels at those locations. The extent to which this occurs depends on the chromium, carbon, niobium, titanium and molybdenum contents; the temperature (the closer to 1,200 F the greater the tendency); and the time in critical temperature ranges, as well as the section mass.

If strength alone is a factor, carbide precipitation is not usually harmful, nor is it too harmful in mildly corrosive media.

Carbide precipitation can be overcome or avoided by (1) lowering the carbon content; (2) increasing the chromium content; (3) adding stabilizing elements; or (4) by subsequent stabilizing heat treatment.

The presence of ferrite, the amount of which can be increased by using stabilizing elements, causes another metallurgical phenomenon, the sigma phase.

This is a Fe-Cr base, brittle compound which forms in the 1,000 to 1,500 F range and is most pronounced between 1,200 and 1,500 F. Its formation is accelerated by prior cold working and may form directly from austenite, but at a considerably slower rate.

A partially effective way to control sigma phase, and hot shortness, is to obtain a steel and weld metal with a specific ferrite range (2 to 8% ferrite and preferably 3 to 5%, provided compositions producing such deposits have suitable short and long time ductilities).

The steel should also have a composition which provides good ductility and stability and is compatible with the heat treatment temperatures and service temperature.

Ferrite content can be estimated by using the magne-gage, which operates on the basis that steel will be magnetic in definite relation to the amount of ferrite it contains.

A solution anneal obtained by heating from 1,850 to 2,050 F and holding for ½ to 1 hour per inch of thickness and rapid cooling, will retard formation of sigma phase and return precipitated carbides into solution. A middle range temperature (1,950 F) is preferred.

Such a heat treatment should only be used if a rapid quench can be given the weldment and if it can be properly supported so that loss of strength and stress due to expansion at very high temperatures do not cause cracking or serious distortion.

. . . from page 8

Tennessee Fabricating closes department

Tennessee Fabricating Co., Memphis, Tenn., has closed its ornamental iron production department.

The firm will devote its fabrication operations exclusively to supplying grillework components to ornamental metals shops throughout the country.

Airite acquires electron beam welder

A high-energy electron beam welder capable of joining dissimilar metals 0.00025-in. thick has been acquired by Airite Products, Inc., Culver City, Calif.

The Hamilton-Zeiss welder will be used on electronic-miniaturization projects.

Colony Welding named as Linde distributor

Colony Welding Supply, Quincy, Mass., has been appointed an authorized distributor by Linde Co., New York City.

Colony is headed by Gary and John Blake.

ASM chapter sponsors arc welding course

The Chicago-Western Chapter of American Society for Metals is sponsoring five Metals Engineering Institute courses beginning January 9.

One course will be on arc welding. The other courses will cover elements of metallurgy, stainless steels, tool steels and corrosion.

Baysinger speaks at Los Angeles AWS meeting

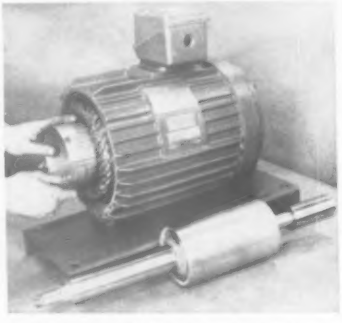
Robert Baysinger of Kaiser Aluminum and Chemical Corp. will be guest speaker at the November 16 meeting of the Los Angeles section of the American Welding Society.

Baysinger will discuss welding of heavy aluminum plate.

At the previous Los Angeles AWS meeting, 95 members and guests heard two speakers discuss major bridge projects of Calif.

Lincoln Foundation presents awards to students, engineers

A FOURTH place award of $160 in the vocational agriculture division of the national high school welding competition sponsored by the James F. Lincoln Arc Welding Foundation went to Danny Faria, Tipton, Calif., (above) for his tractor-carry trailer. Ken Hatch, Byron, Wyo., (right) took first award, $746, in the agriculture education division with his tandem-wheeled hay and machinery trailer. A total of $15,000 was awarded.



PAPER on welded design of canned motor pumps like this one earned a first place award for two Allis-Chalmers employees in The James F. Lincoln Arc Welding Foundation annual design awards.

Lincoln awards $25,000 for arc welded designs

Awards totaling $25,000 for papers on progress in arc welded design have been presented to 105 designers and engineers by The James F. Lincoln Arc Welding Foundation, Cleveland.

Thirty-six awards were presented in two separate divisions, machines and structures.

First award in the machine division went to G. H. Lynn and I. John Niemkiewicz, Allis-Chalmers Mfg. Co., for their paper on redesigning a canned motor pump.

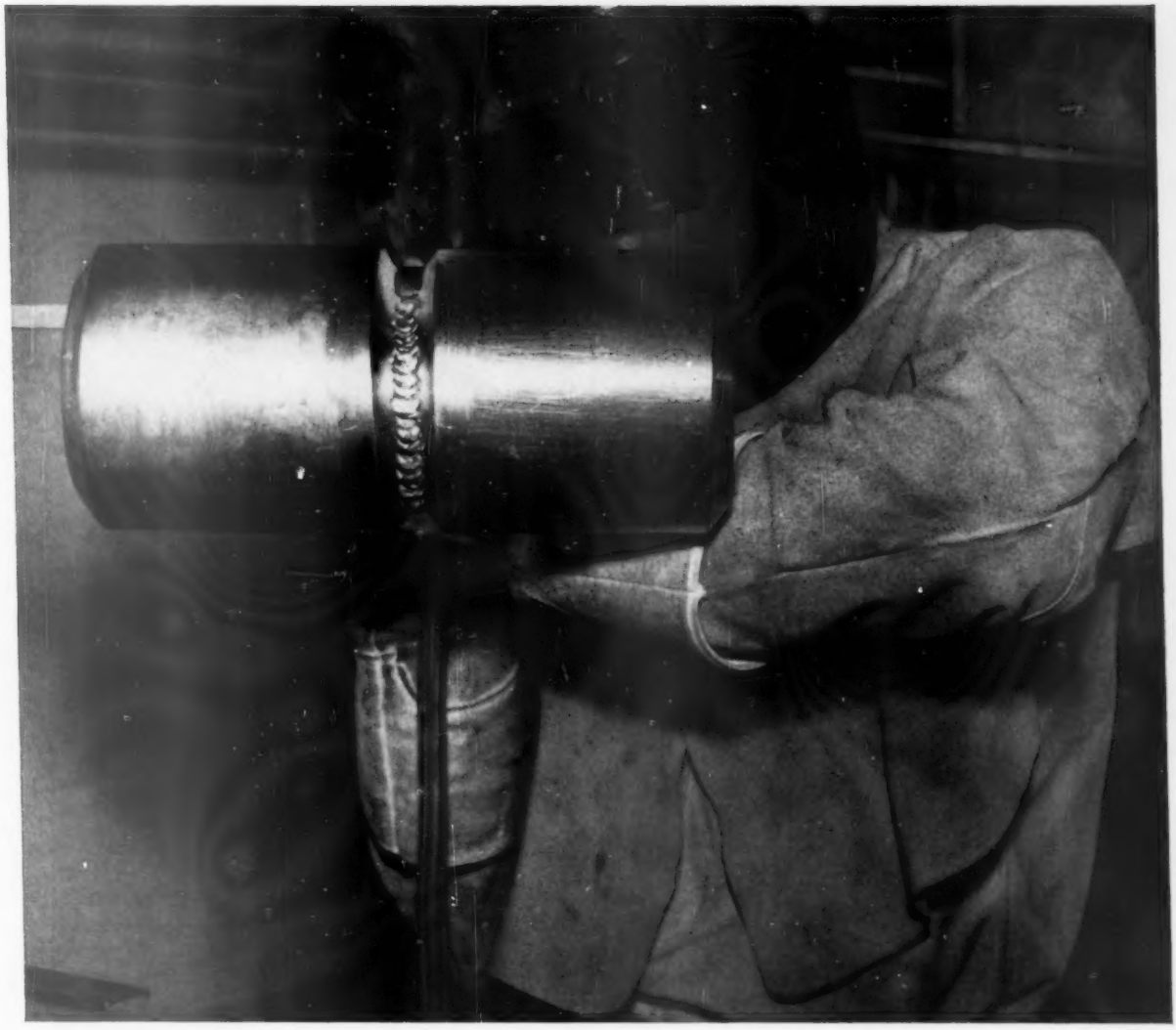
First award in the structure division went to K. E. Dumbauld and D. C. Hoffman, Bureau of Bridges Div. of The Ohio State Highway Dept., for their paper on redesign of deck and deck girders on a continuous haunched girder bridge.

53 engineering students win design awards

The James F. Lincoln Arc Welding Foundation, Cleveland, has granted 53 awards to undergraduate engineering students for arc welded design of machines or structures.

Awards totaling $10,000 were distributed to students representing 29 colleges.

A University of Miami student, Roland W. Gerstenberger, led the machine division with his study of a welded engine block design. James M. O'Neal, an architectural engineering student at Rensselaer Polytechnic Institute, finished first in the structural division with his design of a welded prefabricated space frame.



New MONEL® Welding Electrode 180 permits

all-position welding of MONEL nickel-copper alloys

New MONEL* Welding Electrode 180 has the best operability of any electrode available for all-position welding of MONEL nickel-copper alloys. Its spray-type arc gives minimum spatter and the electrode has more tolerance for variations in the welder's technique. Weld quality is less affected by changes in arc length, welding current, speed of travel, and weave than other commercial electrodes. Slag breaks clean and will not powder. There is no secondary slag.

Deposits from MONEL Welding Electrode 180 match the strength and ductility of the base metal and produce welds having a joint efficiency of 100%.

For the first time you can produce welds in all positions to meet current military and technical society radiographic standards. MONEL Welding Electrode 180 can meet tighter limits on fissuring than can other nickel-copper welding electrodes.

For further information on how MONEL Welding Electrode 180 can upgrade your welding of MONEL nickel-copper alloys, write to:

*Registered trademark

HUNTINGTON ALLOY PRODUCTS DIVISION
The International Nickel Company, Inc.
Huntington 17 West Virginia

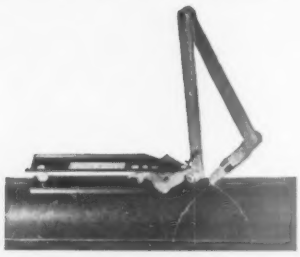
INCO

INCO WELDING PRODUCTS

ELECTRODES • WIRES • FLUXES

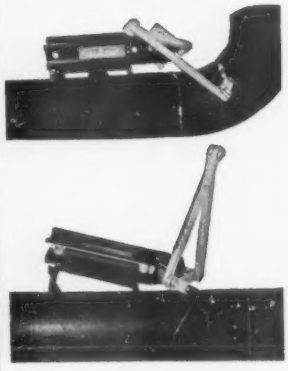
CURV-O-MARK

Contour Marker



Marks off any pipe joint or structural angle cut accurately, easily and without figuring cutbacks. Contour Markers mark all around pipe — save both time and gas. Available in 2 sizes of 1½" to 18" in cross-section, 16" to 48" diameter.

Combination Adaptor

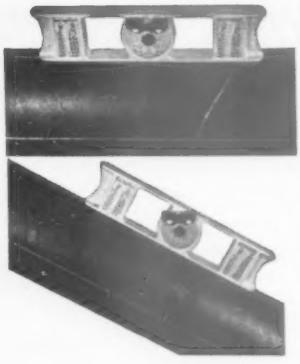


FOR CONTOUR MARKER

Adaptor allows layman to use all sides of Contour Marker in layouts on pipe and structural steel. Standard model marks up to 30" pipe, without having to quarter or halve. Marks over surface irregularities and old welds, and without having to break wrap so far back on wrapped pipe. Compound angles can be marked in one setting of tool; also, any portion of tube turns or 90°. The combination adaptor also furnished for the Jumbo Marker on special order.

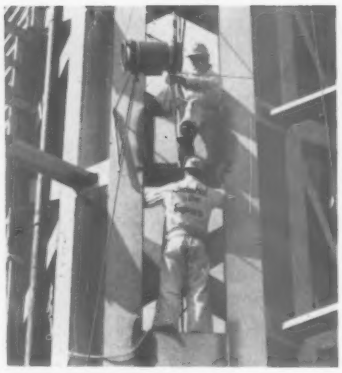
Pro-Mag-Level

Pocket size and equipped with two magnets on each plane for holding level in position. One side is machined flat for flat work, and the other, to a slight V-plane for pipe. Besides level, Pro-Mag-Level is equipped with 90° dial marked in 2½° increments and scales for rise in degree per foot or meter. Frame made of strong cast aluminum.



CONTOUR SALES CORPORATION

1843 E. Compton Boulevard Compton, California

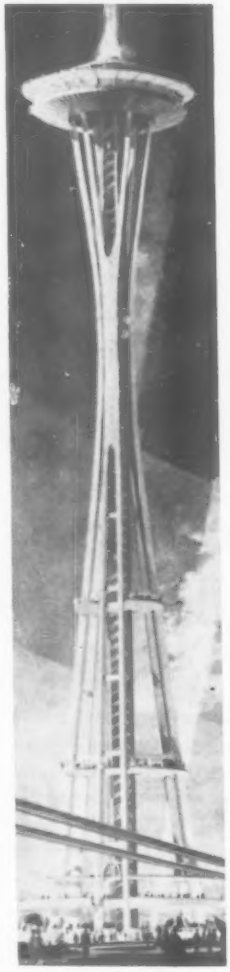


TECHNICIANS radiograph welds on box girders at 75-ft. level of Space Needle designed by John Graham & Co., Seattle.

Space tower's welds get X-ray inspection

AN ALL-WELDED 600-ft-high space tower is being built for the 1962 Seattle World's Fair.

And critical welds in the $2½ million Eiffel Tower-like Space Needle are being nondestructively inspected.



To inspect the six support columns, whose steel plate is more than 2-in. thick, Industrial X-Ray Engineers, Inc., Seattle, are using a radioisotopic system. Specifically, penetration of gamma rays from iridium 192 are used to inspect the columns.

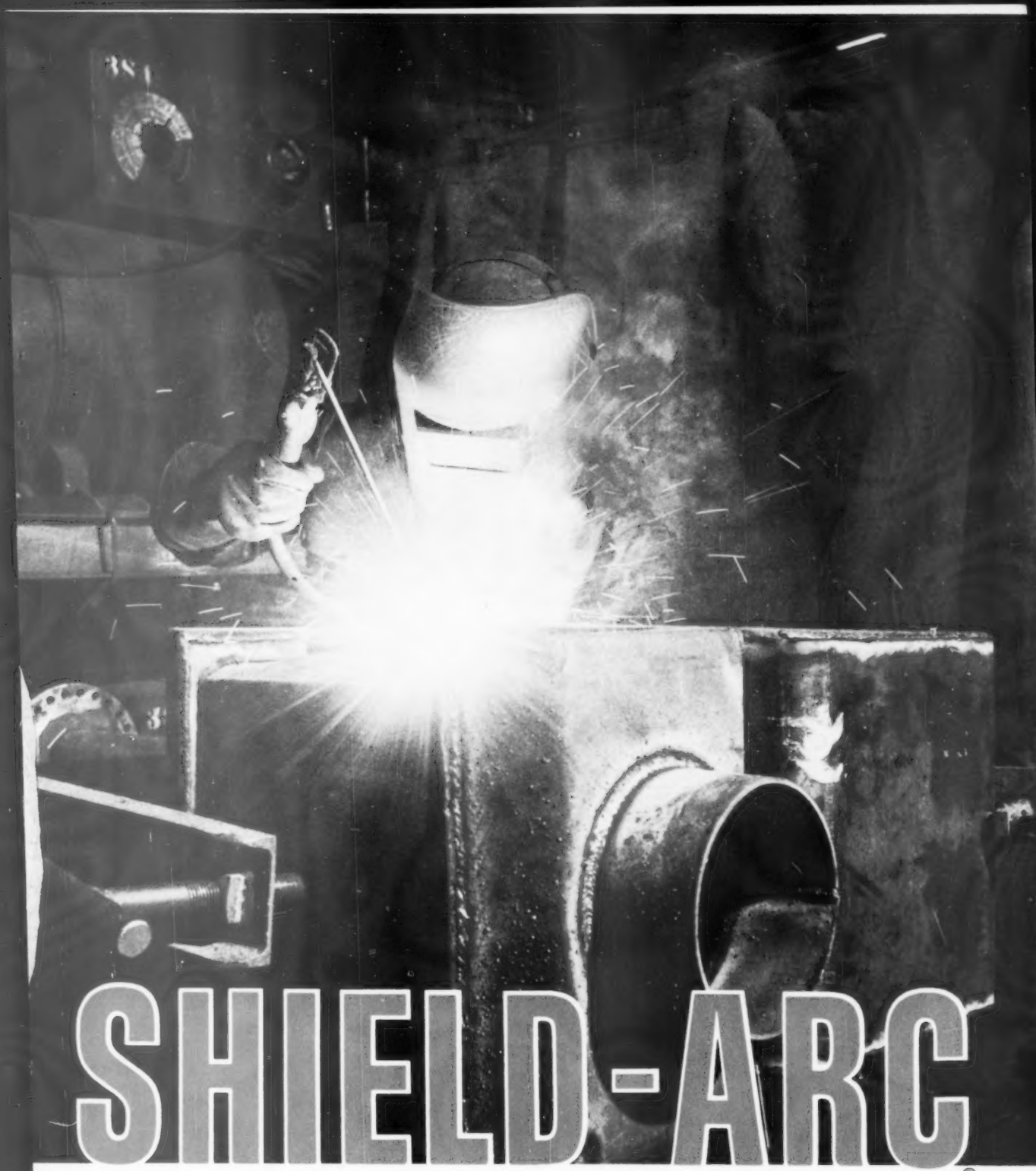
When completed, the tower will be topped by a 220-seat revolving restaurant-observatory section resting directly on a ring box girder strong enough to support a 5-story building. Intermediate platforms will be located at the 100-ft and 200-ft levels.

The ring box girder will be supported by the six columns joined to the core at the 300-ft level.

To detect flaws in intersecting welds of the tower's center core section, which will contain three elevators, a 175,000-volt X-ray machine is being used.

Fillet welds, connecting horizontal and vertical beams are tested with a magnetic particle system.

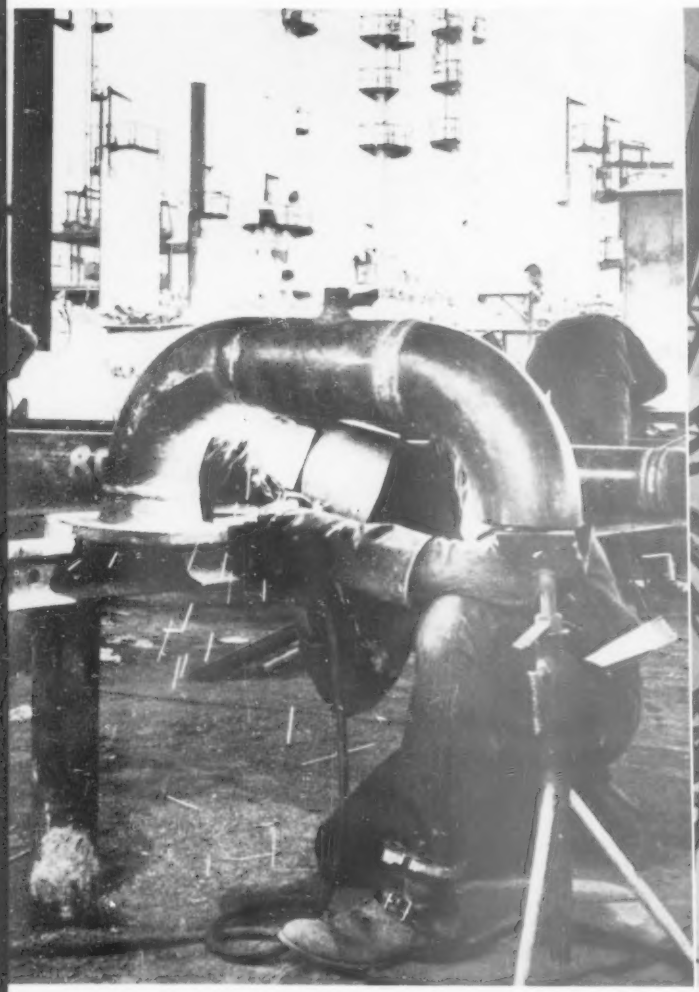
For main butt welds of smaller center core columns, radiographic tests are again used to assure a safe structure.



SHIELD-ARC®

Lincoln **Shield-Arc** motor-generator welders are preferred 3 to 1 over any other kind of arc welder made. Why? Because through the years they have proved reliable, versatile and capable of producing consistently top-quality welds on all kinds of work – from heavy production to routine maintenance. On the following pages, we propose to substantiate these claims.

This is SHIELD-ARC on the job



Here, a **Shield-Arc** is used on a pipe fabricating job. But, any maintenance job which can be performed by manual welding can be performed best with these machines. Their wide range of currents lets you handle sheet one minute, heavy plate the next, stainless steel the next. In every case you'll get easy, fast welding backed by a rugged, dependable machine.

Whether you use **Shield-Arc** motor-generators in the shop or **Shield-Arc** engine welders on outdoor construction work like this, you'll find their design adds to the versatility of manual welding by making every job go easier, faster. And, their use of conservative, oversize components lets you turn out more work, longer, without danger of burning up the machine. These are beefy machines for the really big, tough welding chores.

How can you prove the reliability of any machine? You can't with words, really. But you can look at the record. And the record for consistent, trouble-free performance for **Shield-Arc** seems impressive. Over 400,000 **Shield-Arc** motor-generator sets have been sold and better than 60,000 of them are over 20 years old. A surprising number of them are still going strong today. And, in spite of the many new processes available today, **Shield-Arc's** continue to be in ever greater demand.

Versatility? Dual Continuous Controls let the weldor pick from literally thousands of possible combinations—the precise heat and voltage to suit both his style as well as the necessary arc type and intensity demanded by the job. These controls eliminate the need for compromise settings, assure best results, highest quality . . . and ultimately, the most profits for you. Moreover, each size machine offers a wide current range . . . lets you switch from one kind of job to another . . . quickly. If the weld site is distant from the machine, a remote control device can be installed to let the operator alter the current settings from the point where he's working.

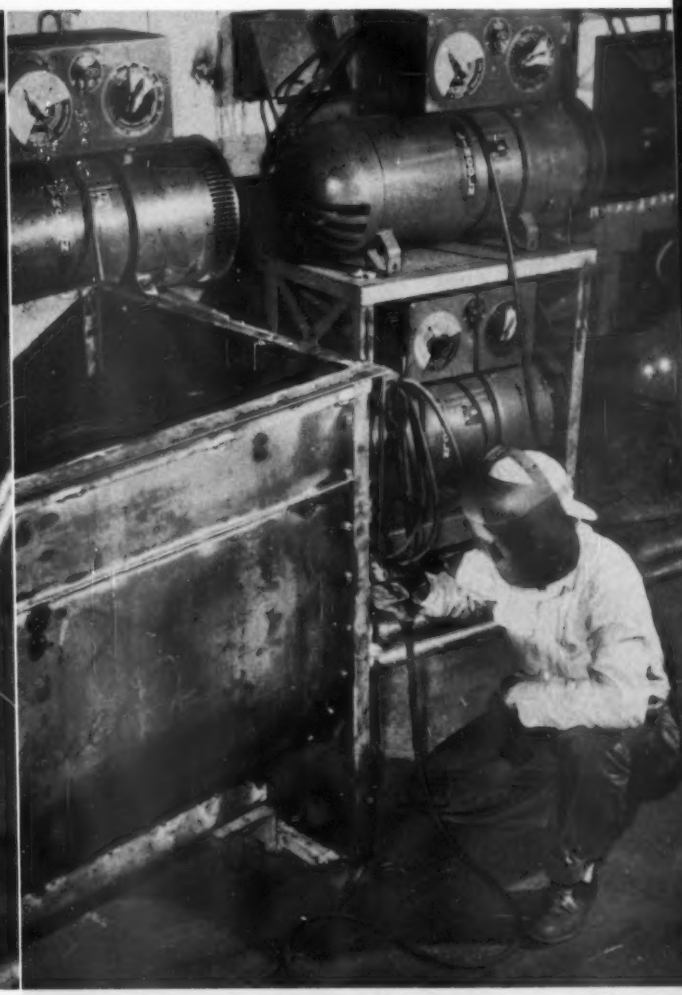
LINCOLN WELDERS

Frequently, with transformer-type machines, output current varies due to changing loads on the line. This can result in inconsistent, poor quality welds. Because **Shield-Arc's** are motor-generator machines, and are unaffected by line voltage variations, you simply don't have this problem. You get the same consistent results all day long, day after day, regardless of the number of machines tied into the line.

All Lincoln welders are built with generous, oversize components. **Shield-Arc's** even more so. This means you can run these babies longer and harder than most other types, even do heavy-duty jobs such as Arcair gouging which often overheats and burns up lesser machines.

It's likely that your shop has one or more **Shield-Arc's** in operation now. You know from experience how they perform. But, if you do not, and if you want all these things from your welders . . . dependability, versatility, performance . . . don't take our word for it. Investigate for yourself the benefits offered by **Shield-Arc's** . . . today.

Why do you see more **Shield-Arc's** employed in heavy-duty, continuous production work like this? It's simple. These machines are designed—both electrically and mechanically—to continue to deliver heat at top efficiency as long as it's needed. Each component—from the generously oversized copper windings to the extra-large shaft and heavy-duty ball bearings—all combine to minimize the possibility of downtime, lost profits.

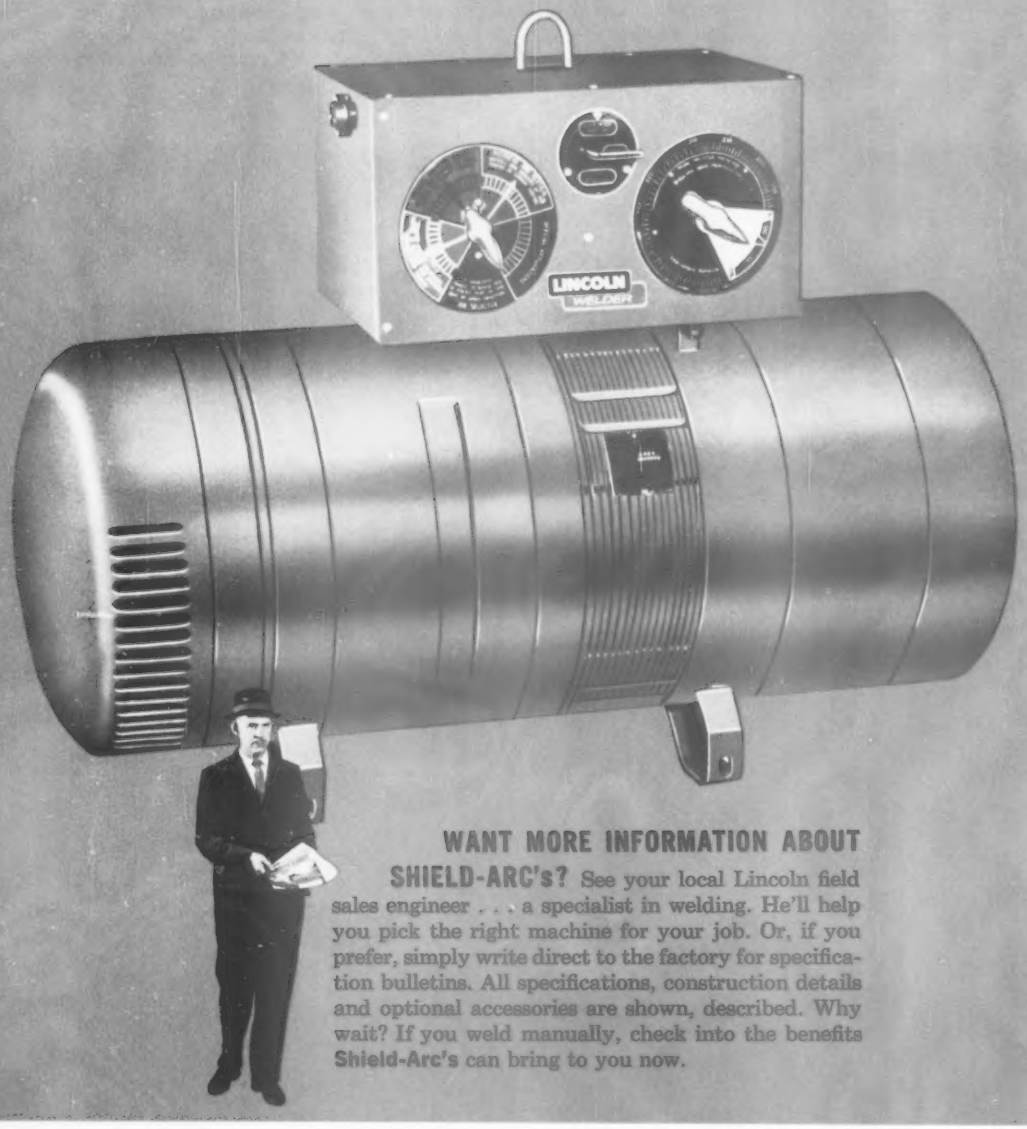


Shield-Arc's Dual Continuous Controls let the weldor select precisely the settings of current and voltage which suit both his style and what his experience tells him is best arc type and intensity for each kind of job. Thus, with a **Shield-Arc**, the weldor can produce the highest quality welds at lowest possible cost. These, of course, translate into higher profits for you.

Pick from several SHIELD-ARC models

Machine pictured is motor-generator model. Shield-Arc DC generators are available with AC motors, DC motors, gasoline engines, diesel engines, and as bare generators for belt driving. All are NEMA rated at 60% duty cycle, 40 volts. These are current ranges for the various sizes. Several types of running gear available.

Machine	Output Current Range Amps
SAE 200	40-300
SAE 300	60-450
SAE 400	80-600
SAE 600	120-750



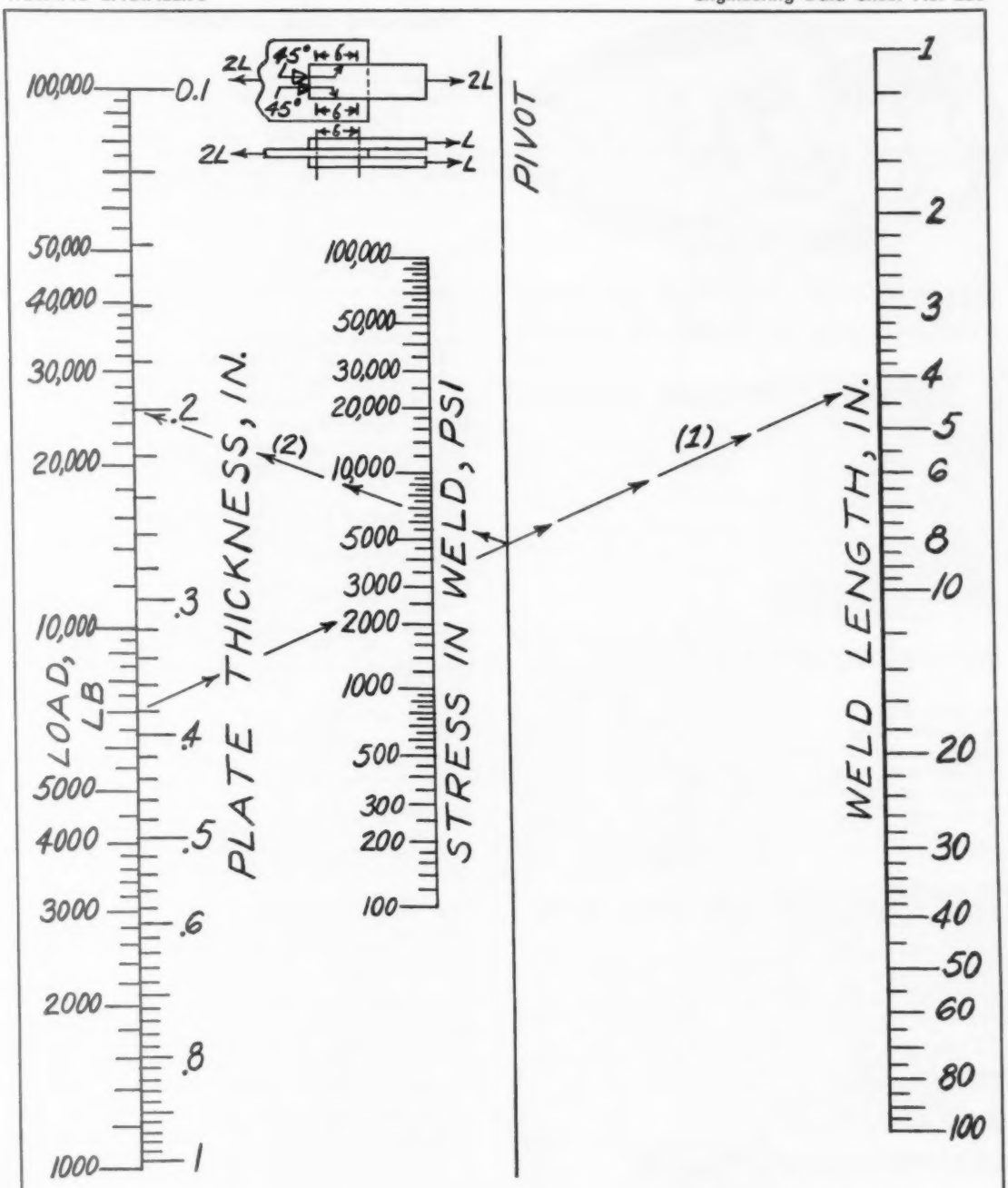
WANT MORE INFORMATION ABOUT SHIELD-ARC's? See your local Lincoln field sales engineer . . . a specialist in welding. He'll help you pick the right machine for your job. Or, if you prefer, simply write direct to the factory for specification bulletins. All specifications, construction details and optional accessories are shown, described. Why wait? If you weld manually, check into the benefits Shield-Arc's can bring to you now.

THE LINCOLN ELECTRIC COMPANY

Department WW-1912 • Cleveland 17, Ohio

THE WORLD'S LARGEST MANUFACTURER OF ARC WELDING EQUIPMENT AND ELECTRODES

LINCOLN ...USA



Computing stress in fillet welds

By **Roger K. Crane**

In office or field, this chart helps compute fillet weld stresses in the 45-deg joint shown. The chart is based on S=L/√2 (t) (l), where S=stress in welds (psi); L=load applied to joint (psi); t=plate thickness (in.); l=weld length (in.).

Note: In these welds, plate thickness is assumed equal to weld size. Weld length approximates plate overlap. Use the chart like this:

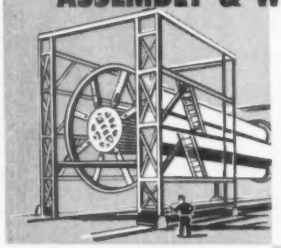
Example: what is the weld stress of the joint shown when applied load is 7,000 psi, weld length is 4 in., and plate thickness is 0.2 in.?

Solution: Enter the chart at left at applied load (7,000 psi) and draw a straight line (1) through weld length (4 in.) at right. From the intersection of this line with the pivot, draw a straight line (2) through plate thickness (0.2 in.) on the left. At intersection, read weld stress as 6,200 psi.

PROGRESSIVE
WELDER & MACHINE CO.

DESIGNERS & BUILDERS OF FINE EQUIPMENT FOR OVER 25 YEARS

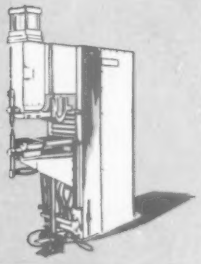
ASSEMBLY & WELDING FIXTURES



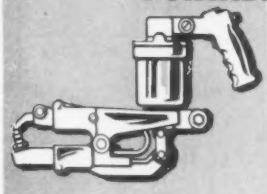
We have the facilities and ability to design and build all types of special fixtures, from mammoth space craft assembly units to tiny precision welding set-ups.

WELDING EQUIPMENT

We offer a complete line of standard and special resistance and arc welding machines. Standard of efficiency and dependability for over 25 years.



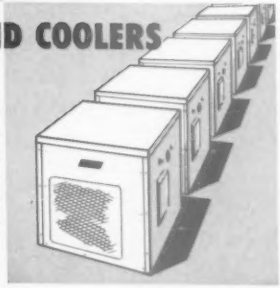
PORTABLE WELDING GUNS



Our standard-chassis hydraulic or pneumatic guns with interchangeable jaw extensions, adaptors, and tips afford thousands of specialized applications at lowest cost.

INDUSTRIAL LIQUID COOLERS

Economical, compact, efficient, low maintenance "packaged cooling" units for tool coolants, hydraulic oils, welders, temperature control systems, delicate instruments and specialized uses.



PROGRESSIVE WELDER & MACHINE CO.
915 Oakland, Pontiac, Mich.

Reprints still available from WE

Reprints of certain articles published in Welding Engineer are still available. A list of these appears below. Reprints may be obtained for 15 cents each, except where otherwise noted. Payment must accompany all orders. For quantity orders, write for special prices. Order by title from: Reprint Editor, Welding Engineer Publications, Inc. Box 28, Morton Grove, Ill.

Design for welding
Basic knowledge required when designing or redesigning for welded construction is detailed and discussed. Sixteen page reprint includes 11 data sheets.

The meaning of weldability
Weldability of carbon steels and alloy steels, as well as some other metals, is discussed. Sixteen page reprint includes three data sheets.

How to weld T-1 steel
Explains how to weld this high-strength low-alloy metal. Includes a data sheet on T-1 mechanical properties.

Fundamentals of oxyacetylene welding
Gives the basic essentials on and primary steps of oxyacetylene welding.

Uses of build-up electrodes
As rebuilding and reclaiming of worn steel parts becomes standard maintenance procedure, build-up electrodes increase in importance. This 2-page reprint lists the qualities necessary for a good build-up material.

A guide to preheat
This 4-page reprint on benefits of preheat includes an engineering data sheet entitled "Recommended preheat for steel alloys."

Acetylene
A 12 page salute to the IAA and acetylene, details the great success of this gas. Includes a history of the IAA and "The Acetylene Journal."

Filler metals for brazing
Brazing filler metals are detailed and each group is analyzed. Includes data sheet on how to select silver brazing alloys.

Explosive welding and forming open another door
A report on one of the newest entries into the welding industry, and how one pioneer company turned theories and practices into realities.

Our modern-day mythology
A rebuttal to some old-wives tales about the hazards of welding fumes, plus safety recommendations for situations where hazards might develop.

Welding the reactive metals
This 12-page reprint describes techniques for Tig welding titanium, zirconium and tantalum. It also gives experimental data on resistance spot welding of tantalum.

Welding 17-4 PH stainless steel
Sound joints can be easily produced in 17-4 PH stainless by proper welding practice. This 4-page reprint details all phases of the procedure.

Non-destructive testing
Four separate articles comprise this 8-page reprint on non-destructive testing: how to interpret radiographs; circumstances and job requirements govern selection of radiation source in inspection; ultrasonic testing; and a program for radiation safety.

VIPs in review . . .

Donald C. Helton has been named manager of the Milwaukee district office for the Welding Products Div. of Harnischfeger Corp., Milwaukee. The district includes Wisconsin and the Upper Peninsula of Michigan.

Helton

White

High Vacuum Equipment Corp., Hingham, Mass., has elected **William B. White** vice president of administration. High Vacuum manufactures electron beam welders.

Richard F. Latt and **Donald F. Moulton** have joined the field service staff of Oakite Products, Inc., New York City. Latt will work in the South Buffalo-New York area and Moulton has been assigned to Vermont.

Machinery & Welder Corp., Chicago, has appointed new officers. **R. L. Kohlbry** is the new president. **Wilbur Juergens** is secretary-treasurer, and **G. F. Meyer** is vice president. These men are also the board of directors of the company.

Will Mitchell, Jr., has been appointed director of the research division of Allis-Chalmers Mfg. Co., Milwaukee.

Andrew Kaul III, chairman and chief executive officer of Speer Carbon Co., Inc., has been elected a director of Air Reduction Co., Inc., New York City. Speer is a subsidiary of Air Reduction.

At Omark Industries, Inc., Portland, Ore., **David G. Bogue** has been named merchandising manager, **Paul J. O'Herron** has been appointed field sales manager and **Richard B. Lewis** has been named chief engineer for United States operations.

Linde Co., New York City, has appointed **J. T. Walmsley** Denver area manager for the Distributor Products Department. His area includes Colorado, Wyoming, Western Kansas and Nebraska and part of New Mexico.

Walmsley

Martin

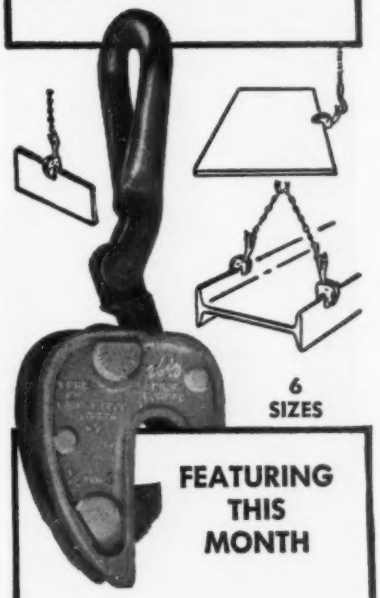
Beasley

Buchanan

At Metal & Thermit Corp., New York City, several changes have been made. **H. E. Martin** has become chairman and chief executive officer. Replacing him as president is **Charles J. Beasley. H. W. Buchanan** has been named executive vice president. **Leonard W. Mawhinney** has been named vice president. **R. A. Bernabo** has been appointed assistant controller and assistant secretary. **Dr. Alexander Ross** has been appointed European technical representative for M&T Chemicals AG.

YOUR BEST MOVE . . . MOVE with **MERRILL** MATERIAL HANDLING DEVICES FOR THE MOST IN *Safety and Economy*

Imitated, but never duplicated, Merrill Lifting Clamps are Drop Forged to give you Safety in Handling and Economy in Operation.



6 SIZES

FEATURING THIS MONTH

LARGE OPENING "G" CLAMP
Designed for lifting and rolling extra heavy and extra thick plates and slabs. Standard 3" ranges to 12". All capacities.

Over 25 Material Handling Devices described in our catalog C-3.

Ask for a copy.

MERRILL BROTHERS
Producers of Drop & Press Forgings
56-81 Arnold Ave., Maspeth, N. Y.
1-60

Circle No. 201 on Welding Info-Aid Card

You can depend on

Tempilstik°

temperature indicating crayons

Each batch of Tempilstiks° is certified for melting point by our laboratory — and independently tested for accuracy by a distinguished firm of metallurgical chemists.

A PRODUCT OF AMERICAN INGENUITY

Tempilstiks° provide a simple and accurate means of determining preheating and stress relieving temperatures in welding operations. Tempilstiks° are widely used as a standard method of checking temperatures in all heat treating—as well as in hundreds of other heat-dependent processes in industry.

Available in 100 systematically spaced temperature ratings—from 100° to 2500° F.....$2.00 each.

Most leading welding supply houses carry Tempilstiks°. If yours is an exception, write to:

WELDING SALES DIVISION

Tempil° CORPORATION
132 West 22nd St., New York 11, N. Y.

Circle No. 202 on Welding Info-Aid Card

Air Reduction Sales Co., New York City, has appointed **R. B. Calhoun** assistant manager of distributor sales for the Pittsburgh district and **S. N. Peters** plant superintendent of the air separation plant now under construction in Johnstown, Pa. **C. J. Langley** has been appointed Philadelphia district manager for Airco and **H. J. Steinmetz,** manager of Air Reduction Sales Co.'s branch office in Huntington, W. Va., retired recently after 27 years with the company.

Steinmetz

Culbert

Charles B. Culbert, Jr., has been named Eastern District sales manager for the welding products division of The McKay Co., Pittsburgh. Culbert has been New York representative since 1949.

Robert Callister of R. E. Duboc Associates, Denver, will represent National Electric Welding Machines Co., Bay City, Mich., in Utah and Idaho.

Robert D. Lichti has been named president and general manager and **H. Arthur Polson** has been named executive vice president of sales for Lihap Industries, a newly-formed company with offices at 13736 Mulberry Drive., Whittier, Calif. The firm will handle steel fabrication and erection.

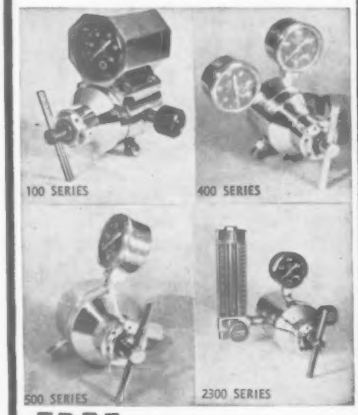
The Carborundum Co., Niagara Falls, N.Y., has appointed three merchandising district sales managers: **Kenneth R. Smith,** Buffalo-Pittsburgh; **James H. Jones,** Philadelphia; and **Lenard C. Murphy,** Cleveland-Detroit.

John G. Norris has been appointed to the newly-created post of assistant to the president of Fansteel Metallurgical Corp., North Chicago, Ill.

Circle No. 203 on Welding Info-Aid Card

ANYWAY YOU LOOK AT IT, IT'S OXO

THE SAFEST REGULATOR MADE



FREE: Write for complete Catalog showing all Models.

OXO

Welding Equipment Co.
Cedar and Oak Streets
New Lenox, Illinois

FROMMELT

PORTO-SCREEN

FROMMELT PORTABLE SELF-STANDING PROTECTIVE SCREEN

...FOLDS COMPACTLY FOR CARRYING OR STORING

Choice of Models and Fabrics

A-SERIES "50"
Sold in Kit Form — Hardware, Curtains, Hooks. "You Supply your own pipe".

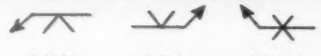
B-SERIES "60"
Complete with Tubular Aluminum Frames and Curtains, Factory Assembled.

WRITE FOR DETAILS
FROMMELT INDUSTRIES, INC.
Dubuque, Iowa

Circle No. 204 on Welding Info-Aid Card

Circle No. 205 on Welding Info-Aid Card

Symbols for Welding



V-Weld Arrow Side | V-Weld Other Side | V-Weld Both Sides

Symbol of Quality

HI-AMP

Only Ground Clamps by HI-AMP have a tough spring that can't knock out. Broad contact base means a better ground and better welding results. Wide opening jaws fit any shape. Made of high copper alloy.

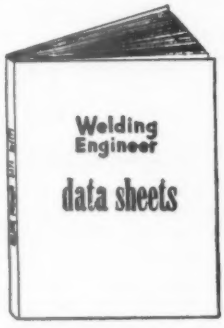
FREE Large 8½x11 chart shows symbols for arc, gas and resistance welding.

WRITE TO:

LENCO, INC.

350 West Adams Jackson, Mo.

Order Your Newly Revised Third Edition Now



This cross-indexed volume contains 134 of the best Data Sheets appearing in WELDING ENGINEER in the past 20 years. Yet it costs only $1.60.

See your welding supply distributor or use coupon below.

WELDING ENGINEER
P.O. Box 28, Morton Grove, Ill.

Please send me .....copies of the Welding Engineer Data Sheets. I enclose ☐ Check ☐ money order ☐ Bill me.

Name .....
Address .....
City ..... Zone ..... State .....
Company .....
Title .....

Ed Pierre and **Bill Oldershaw** have been appointed to the staff of Miller Electric Mfg. Co., Appleton, Wis. Pierre is in the technical sales department. Oldershaw is a technical representative. **A. R. Finch** has joined the advertising staff of Miller Electric Manufacturing Co.

Pierre

Oldershaw

Finch

Oros

Alvin K. Oros has joined Hobart Bros. Co., Troy, Ohio, as a welding engineer.

Mabbett K. Reckord, Jr., has been appointed assistant manager of sales for United States Steel Corp. in Chicago.

DIED . . .

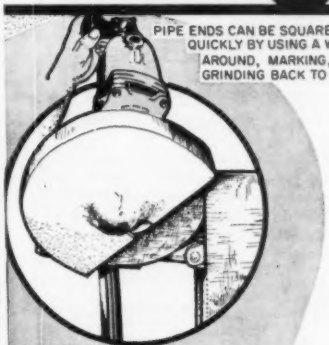
Howard J. Daly, 64, vice president and director of Norton Co., Worcester, Mass., died last month at Niagara Falls. Mr. Daly was general manager of Norton's electric furnace plants at Chippawa, Ontario; Cap-de-la-Madeleine, Quebec; and Huntsville, Ala. He is survived by his widow, three sons and five grandchildren

Joseph A. Trainor, former sales manager of Taylor-Wharton Co., High Bridge, N.J., died recently. Mr. Trainor joined Taylor-Wharton in 1913, was named sales manager in 1937 and retired in 1955 while serving as sales consultant.

IF YOU NEED TO BEVEL PIPE . . . . . .

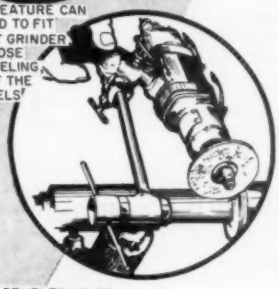
You Need

SPEEDY PIPE BEVELER

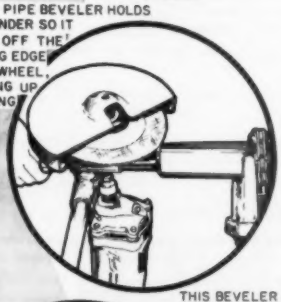


PIPE ENDS CAN BE SQUARED OFF QUICKLY BY USING A WRAP-AROUND, MARKING, THEN GRINDING BACK TO MARK.

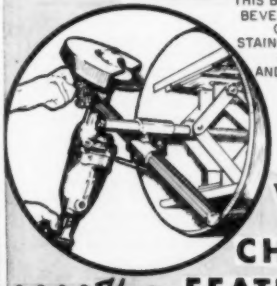
THIS ADDED FEATURE CAN BE PURCHASED TO FIT YOUR PEANUT GRINDER. IDEAL FOR CLOSE QUARTER BEVELING. IT WORKS OFF THE SAME MANDRELS AS STRAIGHT SHANK GRINDERS.



SPEEDY PIPE BEVELER HOLDS THE GRINDER SO IT WORKS OFF THE CUTTING EDGE OF THE WHEEL, SPEEDING UP BEVELING TIME.



THIS BEVELER WILL BEVEL ALL TYPES OF PIPE, STAINLESS STEEL STEEL, AND ALUMINUM.



CHECK . . . . These FEATURES

- GIVES CONSTANT FACTORY BEVEL ON ALL SIZES OF PIPE FROM ½" TO 24"
- SPEEDY PIPE BEVELER ATTACHMENTS ARE DESIGNED TO FIT STANDARD STRAIGHT SHANK GRINDERS—AIR OR ELECTRIC.
- SPEEDY PIPE BEVELER PROVIDES SELF CENTERING INTERNAL EXPANDING MANDRELS FOR PIPE SIZES ½", 2", 2½", 3", 4", 6" TO 24" IN ONE PORTABLE STORAGE CASE.

WRITE FOR FREE BROCHURE . . . .

• *Speedy* Pipe Beveler •

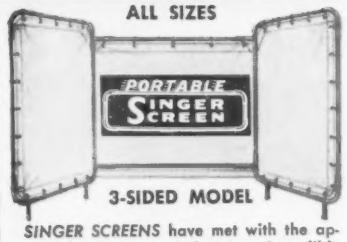
235 South OAK — BLACKFOOT, IDAHO

Circle No. 206 on Welding Info-Aid Card

Circle No. 207 on Welding Info-Aid Card

THOUSANDS NOW IN USE

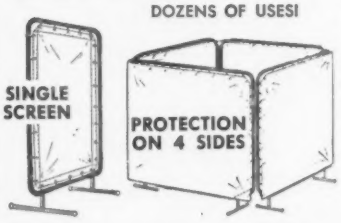
ALL SIZES



3-SIDED MODEL

SINGER SCREENS have met with the approval of many industries. Incredibly light in weight. Rust-proof steel. No threads —assembles in minutes. Curtains of duck, neoprene-coated fiber glass or Johns-Manville aluminized asbestos cloth.

DOZENS OF USES!



NEW BIG CATALOG

Describes screens in detail. Complete line of work gloves, welding gloves and safety clothing.

Ask your dealer or write: *Special Products Division*

SINGER GLOVE MFG. CO.®

860 W. WEED St., CHICAGO 22, ILL.

In 1936, MORT CLARK, then Vice-President of the World's largest sign manufacturer, wanted a welded galvanized sign frame. Every welder manufacturer said it couldn't be done . . . Mort Clark did it, received a check and certificate of achievement from the Lincoln Welding foundation — and

MORT CLARK'S **GALV-WELD** ALLOY ORIGINAL & GENUINE

WAS BORN

The Navy didn't believe, tested it 3384 hours in salt spray (100 hours is normal), then approved it. Westinghouse reports Galv-Weld roof sign, installed 1936 — still perfect in 1959 — 23 YEARS LATER!

TIME PROVEN - MODESTLY PRICED
WHY EXPERIMENT?

Regalvanizes corrosive seams and areas where galvanizing is burned away by welding, skipped in hot dip galvanizing, or abraded in fabrication.

Eliminates corrosion areas produced by welding, so that weld will stand up under paint, WITHOUT rust, as on ornamental iron. Simply use residual heat from welding, or reheat, wire brush, and apply. No fluxing—No fumes.

Makes every welder a galvanizer of small weldments or parts. Repairs chipped porcelain, rusted appliances, rusted auto, truck or trailer bodies, frames, fenders, or other steel products. Can be readily refinished to match surrounding surface.

Ideal for pipe joints, galvanized structures, water and fuel tanks, duct systems, cold storage lockers, sinks, drains, washers, towers, steel buildings, railings, etc.

Some distributor franchises still available. Cash in on consistent campaign now running in 18 national magazines.

Mail Coupon Today

GALV-WELD PRODUCTS

Dept. WE — Box 1303 — Bradenton, Fla.

Send Information User ☐ Distributor ☐ Dealer ☐ Free Sample ☐

Name ..... Address .....

City ..... State .....

Circle No. 208 on Welding Info-Aid Card

In retrospect

(Taken from **Welding Engineer** issues of November, 1916, 1931 and 1946)

—45 Years Ago—

A F. Jenkins succeeds J. M. Morehead as president of the International Acetylene Association, which held its annual meeting last month in New York City. J. F. Earl is vice president, and A. Cressy Morrison will continue as secretary-treasurer.

—30 Years Ago—

W. C. Keely, Jr., National Carbide Corp. (Air Reduction Co.), was elected president of the International Acetylene Association in Chicago. The Morehead Medal was awarded to A. Cressy Morrison, secretary of IAA for the past 25 years. This year he retired from that post and was succeeded by H. F. Reinhard.

A. A. Probeck has been named sales manager for Federal Machine and Welder Co., Warren, Ohio.

—15 Years Ago—

The Sutton-Garten Co., welding distributors, recently opened a new salesroom and warehouse at 1701 S. Harrison St., Fort Wayne, Ind. Russell F. McNutt has been appointed manager.

Harold E. Piggott has been promoted to general manager of Dockson Corp., Detroit.

George Kemper has been transferred to the Atlanta district office of A. O. Smith Corp.

WHERE TO BUY

ALLEN **FLUXES** SODERING BRAZING & WELDING

L. B. ALLEN CO. INC.

9314 Berenice, Schiller Park, Ill. (in metropolitan Chicago area)

AGGRESSIVE SALESMEN AND SALES APPLICATION ENGINEERS

Does your present position offer potentials you expected?

Prominent Industrial Gas producer now expanding in Boston-New York area offers exceptional career opportunities.

Your growth will follow Division's planned expansion with attractive compensations (salary, commission, and incentives).

Preference given applicants with sales background in Welding Gases and Equipment — having engineering experience. Applicants should be willing to eventually relocate.

Prompt and confidential consideration given applicants submitting complete resumes, including salary requirements.

Personnel Office, Dept. WE

135 South LaSalle Street, Chicago 3, Ill.

LIQUID CARBONIC
DIVISION OF GENERAL DYNAMICS

WELDING ENGINEER for NUCLEAR SUBMARINES

An unusually attractive opportunity for a Welding Engineer now exists at the Portsmouth Naval Shipyard in the design, construction and repair of nuclear-powered HY80 hull submarines.

Experience and knowledge of advanced submarine hulls is desirable, but not required.

Excellent resort living on or near the ocean. Starting salary $12,210, plus all the benefits of Career Civil Service. Transportation will be paid. Send personal information to:

Director, Industrial Relations
Portsmouth Naval Shipyard
Portsmouth, New Hampshire

THE WELDING SHOPPER

UNDISPLAYED RATE

(Not available for equipment advertising) $1.10 a line minimum 6 lines. To figure advance payment, count 5 average words as a line.

INDIVIDUAL EMPLOYMENT WANTED advertising rate is ½ the above rate; minimum $5, payable in advance.

INFORMATION

BOX NUMBERS count 1 line additional in undisplayed ads.

DISCOUNT OF 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

DISPLAY RATE

The advertising rate is $12.00 per inch for all advertising appearing on other than a contract basis. Maximum size of display ad is 4 col. in. Contract rates quoted on request.

AN ADVERTISING INCH is measured ⅞ in. vertically on one column, 3 columns — 30 inches — to a page.

HELP WANTED

INDUSTRIAL SALESMAN

Nationally known manufacturer of compressed gases requires a man with sales experience and initiative for future managerial position. Chicago territory. Liberal salary plus expenses, hospitalization and other company benefits. Automobile necessary. Age 25-35. Send resume of past experience. Replies strictly confidential. Our men know of this ad. Write Box No. 1122, c/o Welding Engineer, 5826 Dempster St., Morton Grove, Ill.

HELP WANTED

SALES REPRESENTATIVES

Prominent National Manufacturer of arc welding accessories has openings in Eastern and Southeast territories for qualified Sales Representatives. Position requires moderate travel, proven sales ability, and willingness to relocate if necessary. Prefer age 30 to 40. Submit complete details of personal history and qualifications, with required starting salary to P.O. Box 845, West Caldwell, N. J. Tweco Products, Inc. Inquiries held in strict confidence.

SCHOOL

MANUFACTURERS - CONTRACTORS. Eliminate high training costs. Hire all position combination weldors ready for certification. MODERNWELD TRAINING & PLACEMENT, 1740 Broadway, Schenectady, N. Y.

WELDING TRAINING. Complete or brush up courses in oxy-acetylene welding & cutting, Manual Arc, TIG, Automatic, Pipe (up & downhill), sheet metal, etc. Precode test training. Request bulletin from — Hobart Welding School, Box U-1112, Troy, Ohio.

LEGAL NOTICE

STATEMENT REQUIRED BY THE ACT OF AUGUST 24, 1912, AS AMENDED BY THE ACTS OF MARCH 3, 1933, JULY 2, 1946 AND JUNE 11, 1960 (74 STAT. 208) SHOWING THE OWNERSHIP, MANAGEMENT, AND CIRCULATION OF

Welding Engineer published monthly (two issues in June) at Chicago, Ill, for October 1, 1961.

1. The names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, Welding Engineer Publications, Inc., 5826 Dempster St., Morton Grove, Ill.; Editor, F. T. Tancula, 5826 Dempster St., Morton Grove, Ill.; Managing editor, G. J. Cannizzo, 5826 Dempster St., Morton Grove, Ill.; Business manager, T. B. Jefferson, 5826 Dempster St., Morton Grove, Ill.

2. The owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding 1 per cent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owner must be given. If owned by a partnership or other unincorporated firm, its name and address, as well as that of each individual member, must be given.) Welding Engineer Publications, Inc., 5826 Dempster St., Morton Grove, Ill.; T. B. Jefferson, 5826 Dempster St., Morton Grove, Ill.; Elsie R. Jefferson, 5826 Dempster St., Morton Grove, Ill.; Anna B. Jefferson, 12 West 58th St. Terrace, Kansas City 13, Mo.

3. The known bondholders, mortgagees, and other security holders owning or holding 1 percent or more of total amount of bonds, mortgages, or other securities are; (if there are none, so state.) None.

4. Paragraphs 2 and 3 include, in cases where the stockholders or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting; also the statements in the two paragraphs show the affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner.

5. The average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the 12 months preceding the date shown above was: (This information is required by the Act of June 11, 1960 to be included in all statements regardless of frequency of issue.) 14,913.

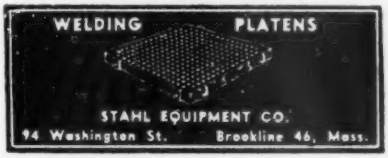
T. B. JEFFERSON, Publisher

Sworn to and subscribed before me this 15th day of September, 1961.

[SEAL] JACK MACKENBERG
Notary Public

(My commission expires Dec. 8, 1962.)

EQUIPMENT FOR SALE



POSITIONERS & PLATENS

1-4600#-12" P&H WP-3; 2-6000# RANSOME Positioners. Bargain prices. 8 Welding platens, 5x5, 3" depth, 6" skirt; 1 1/2" sq. holes on 3" centers. Used but not worn. No cracks; excellent condition. Price $300.00 ea. FOB Phila., Pa.

J. A. CUNNINGHAM EQUIPMENT, INC.
2025 Trenton Avenue Philadelphia 25, Pa.

AIRCO CUTTING MACHINE PARTS

Huge inventory of mechanical parts (no electrical) for Airco No. 10 and No. 4 Radiographs, No. 10 Planograph and No. 40 Travographs. Send for part lists.

RALL SUPPLY CO., 51 E. 42nd St., N.Y.C. 17

EQUIPMENT FOR SALE

OXYGEN PLANT

40 meter, up to 1600 cu. ft. per hour Factory rebuilt column as new. Liquid pump new; guaranteed. $20,000 net f.o.b. Detroit. Total value with electrical equipment $45,000.

ACETOGEN GAS COMPANY
20137 Sherwood Ave. Detroit, Michigan

This is your classified page. Use it to:

Seek help, sell surplus items
Buy hard-to-get items, etc.

Send your classified advertisements to:

WELDING ENGINEER
5826 Dempster St. Morton Grove, Ill.

Because you gave the UNITED way

- **28,000 agencies will continue to provide vital health, welfare, and recreation services**
- **81 million people will be helped**

Your once-a-year gift pays dividends all year long.

UNITED

To get your free copies, circle the appropriate number on Welding Info-Aid card. ➳

LITERATURE for your library

HARDFACING ELECTRODES — Alloy Rods Co. Individual data sheets form this 64-page illustrated catalog on hardfacing wire and wire feed units for semi-automatic and automatic applications.
Circle No. 76 on Info-Aid Card.

ELECTRONIC INFORMATION — American Society for Metals. Eight-page brochure describes a new electronic system of searching technical articles, documents and patents on metals and related subjects for any specific aspect.
Circle No. 77 on Info-Aid Card.

CORRECTION CAPACITORS — General Electric Co. GEZ-3306 4 pages illustrated describes power factor correction capacitors for arc welding applications.
Circle No. 78 on Info-Aid Card.

HYDRAULIC CYLINDERS—The S-P Mfg. Corp. Four-page Bulletin 10C includes cutaway cylinder illustration to show construction and operating advantages of hydraulic cylinder line.
Circle No. 79 on Info-Aid Card.

MAGNIFYING LENSES — The Buell W. Nutt Co. Booklet gives suggestions on how to select magnifying plates and lenses for welding helmets, goggles and hand shields.
Circle No. 80 on Info-Aid Card.

TUBE PRODUCTION — The McKay Machine Co. Bulletin No. 107, 34 pages in color, illustrates and describes line of tube production equipment including standard tube welding mills.
Circle No. 81 on Info-Aid Card.

FLASH WELDERS—Thomson Electric Welder Co. Form 6-3-01, 4 pages, gives complete specifications of 100, 150 and 200-kva rated flash welders.
Circle No. 82 on Info-Aid Card.

TACK WELDING—J. B. Nottingham & Co., Inc. Tack welding with d-c power from a multi-arc system is facilitated by control units described in this data sheet.
Circle No. 83 on Info-Aid Card.

BRONZE ALLOYS — Ampco Metal, Inc. Bulletin G-61, 12 pages illustrated, lists 42 specification bronzes plus heat-treated variations. Bulletin lists nominal chemical and average physical properties, available forms and applications.
Circle No. 84 on Info-Aid Card.

ARC WELDING PRODUCTS — The Lincoln Electric Co. Bulletin 7000.7 gives information on full line of arc welding products including AWS electrode classification information.
Circle No. 85 on Info-Aid Card.

SPOT WELDING—Aro Spot Welder Corp. Sheet 004.77.M.30 gives information on air-operated fully-automatic spot welding gun including specifications.
Circle No. 86 on Info-Aid Card.

X-RAY INSTRUMENTATION—Philips Electronic Instruments. Twenty-eight page catalog contains specifications and operating data on seven instruments for X-ray research and production control.
Circle No. 87 on Info-Aid Card.

PORTABLE X-RAY UNITS—Balteau Electric Corp. Baltospot 15, 140, and 200 portable X-ray units are illustrated and discussed in this series of sheets.
Circle No. 88 on Info-Aid Card.

HARDFACING OVERLAYS — Wall Colmonoy Corp. Data Sheet No. T-4 outlines procedural recommendations for controlled cooling of hardfacing overlays when applied to Martensitic 400 Series stainless steels.
Circle No. 89 on Info-Aid Card.

CUTTING, ABRASIVE TOOLS — Starlite Industries, Inc. Catalog F-60 is illustrated 32-page guide to various diamond abrasive tools and carbide rotary tools.
Circle No. 90 on Info-Aid Card.

WATER COOLING — Bernard Welding Equipment Co. Nine-page pamphlet explains the use of various liquid cooling methods for welding equipment and gives recommendations for specific applications.
Circle No. 91 on Info-Aid Card.

WELDOR'S SQUARE — Tod-O Mfg. Co. Illustrated sheet describes weldor's layout and cutting square which eliminates need for C clamps and cutting guides.
Circle No. 92 on Info-Aid Card.

ABRASIVE FABRIC—Bay State Abrasive Products Co. Form 35 tells about all-purpose abrasive fabric which can get into hard-to-reach spots.
Circle No. 93 on Info-Aid Card.

WELDERS, ACCESSORIES — Twentieth Century Mfg. Co. Series of illustrated sheets (814) describes welders, air compressors and accessories including helmets, electrode holders, cable.
Circle No. 94 on Info-Aid Card.

PULP DIGESTER CLADDING—Air Reduction Sales Co. Form ADR 131 includes two articles on pulp digester cladding.
Circle No. 95 on Info-Aid Card.

ELECTRODE FORCE GAGE—Instrument Control Co. Welding electrode force gage is illustrated and described in this sheet which includes prices.
Circle No. 96 on Info-Aid Card.

CYLINDERS — Walter Kidde & Co., Inc. Form No. C3R2 is an illustrated 8-page guide to standard cylinders complete with charts of cylinder dimensions and other data.
Circle No. 97 on Info-Aid Card.

ELECTRODES, WIRE FLUXES — Hobart Bros. Co. EW-216 is a 24-page comprehensive listing of a variety of electrodes, wire and flux.
Circle No. 98 on Info-Aid Card.

FLAW DETECTOR — Curtiss-Wright Corp. CS 104-00la is a single-page illustrated sheet giving typical applications and specifications of a portable ultrasonic flaw detector.
Circle No. 99 on Info-Aid Card.

PIPE ROTATORS—Cecil C. Peck Co. Series of illustrated sheets describes various pipe rotating machines for welding and cutting operations.
Circle No. 100 on Info-Aid Card.

ALUMINUM WELDING — Oakite Products, Inc. Eight-page booklet (F11026) tells how to prepare aluminum for resistance welding.
Circle No. 101 on Info-Aid Card.

DRY BOX — Controlled Atmosphere Enclosures Mfg. Co., Inc. Sheet No. 28-53 includes a photograph and general description of a low humidity dry box for welding special metals in dry atmosphere.
Circle No. 102 on Info-Aid Card.

WELDING WIRE, RODS — Linde Co. Catalog F-1486 describes various wires for all continuously-fed electrode welding processes including submerged arc, Mig and CO_2-flux.
Circle No. 103 on Info-Aid Card.

Make a habit of folding out the INFO-AID cards as you begin to read each issue of WELDING ENGINEER so that you can easily circle the appropriate numbers.

WELDING info-aids

To receive literature, catalogs and bulletins described on this page, and the preceding and following pages; for more information on products or services advertised in this issue; and for more information about

NEW PRODUCTS on pages 26-36

USE THESE HANDY FOLD-OUT CARDS (post paid) ⟶

PLEASE: Fill out all lines on card. Illegible or incomplete addresses may keep you from receiving the information you desire.

INFO-AID card is valid for only three (3) months. After that, write directly to the manufacturer, describing fully the informaton and/or literature wanted.

Advertisers' Literature

Literature offered in advertisements which were received up to the 5th of last month. To get the literature you want circle numbers on fold-out card at right.

171. Ace-Sycamore, Inc. — Form WB-961 available on the new Ace "44" portable spot welder.

185. Alloy Rods Co. — Booklet available "Handbook for Welding Low Alloy High Tensile Steels."

179. All-State Welding Alloys Co., Inc. — "Spoolarc" literature on the spool wire manufactured by All-State is available also instruction manual.

159. Ampco Metal, Inc. — Catalog and price list available on resistance welding electrode and name of your nearest distributor.

210. Anaconda American Brass Co. — Send for a copy of Publication B-13 for further information on welding with Anaconda copper and copper alloys.

162. Aronson Machine Co., Inc. — Detailed engineering data on Aronson positioners available.

154. Bernard Welding Equipment Co. — Bulletin SS7 available, describing the cost saving features of "Shortstub" electrode holders.

160. Bridgeport Brass Co. — Booklet available, "Bronze Welding" on Bridgeport welding rods.

172. Brunmar Commercial Corp. — Literature and price list available on the A.E.G. Universal Angle Grinder and "Ipaflex" and "Ipacut" wheels.

Name

Title

Company

Address

City Zone State

WELDING ENGINEER NOVEMBER, 1961

Card not good after February 1, 1962

Please send me more information about:

1	2	3	4	5	6	7	8	9	10	11	12	13	14
15	16	17	18	19	20	21	22	23	24	25	26	27	28
29	30	31	32	33	34	35	36	37	38	39	40	41	42
43	44	45	46	47	48	49	50	51	52	53	54	55	56
57	58	59	60	61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80	81	82	83	84
85	86	87	88	89	90	91	92	93	94	95	96	97	98
99	100	101	102	103	104	105	106	107	108	109	110	111	112
113	114	115	116	117	118	119	120	121	122	123	124	125	126
127	128	129	130	131	132	133	134	135	136	137	138	139	140
141	142	143	144	145	146	147	148	149	150	151	152	153	154
155	156	157	158	159	160	161	162	163	164	165	166	167	168
169	170	171	172	173	174	175	176	177	178	179	180	181	182
183	184	185	186	187	188	189	190	191	192	193	194	195	196
197	198	199	200	201	202	203	204	205	206	207	208	209	210
211	212	213	214	215	216	217	218	219	220	221	222	223	224
225	226	227	228	229	230	231	232	233	234	235	236	237	238
239	240	241	242	243	244	245	246	247	248	249	250		

Name

Title

Company

Address

City Zone State

WELDING ENGINEER NOVEMBER, 1961

Card not good after February 1, 1962

Please send me more information about:

1	2	3	4	5	6	7	8	9	10	11	12	13	14
15	16	17	18	19	20	21	22	23	24	25	26	27	28
29	30	31	32	33	34	35	36	37	38	39	40	41	42
43	44	45	46	47	48	49	50	51	52	53	54	55	56
57	58	59	60	61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80	81	82	83	84
85	86	87	88	89	90	91	92	93	94	95	96	97	98
99	100	101	102	103	104	105	106	107	108	109	110	111	112
113	114	115	116	117	118	119	120	121	122	123	124	125	126
127	128	129	130	131	132	133	134	135	136	137	138	139	140
141	142	143	144	145	146	147	148	149	150	151	152	153	154
155	156	157	158	159	160	161	162	163	164	165	166	167	168
169	170	171	172	173	174	175	176	177	178	179	180	181	182
183	184	185	186	187	188	189	190	191	192	193	194	195	196
197	198	199	200	201	202	203	204	205	206	207	208	209	210
211	212	213	214	215	216	217	218	219	220	221	222	223	224
225	226	227	228	229	230	231	232	233	234	235	236	237	238
239	240	241	242	243	244	245	246	247	248	249	250		

Postage Will Be Paid by Addressee

BUSINESS REPLY CARD
First Class Permit No. 32, Morton Grove, Ill.

Welding Info-Aids
Welding Engineer
P. O. Box 28
Morton Grove, Ill.

No Postage Stamp Necessary If Mailed in the United States

Postage Will Be Paid by Addressee

BUSINESS REPLY CARD
First Class Permit No. 32, Morton Grove, Ill.

Welding Info-Aids
Welding Engineer
P. O. Box 28
Morton Grove, Ill.

No Postage Stamp Necessary If Mailed in the United States

ADVERTISERS IN THIS ISSUE

This advertisers' index is included as a convenience and is in no w a part of the advertising contract. Although every care has been tak to index accurately, some errors may have occurred and no allowa will be made for them.

A

Ace-Sycamore, Inc. 36
Air Reduction Chemical & Carbide Co. 64
Air Reduction Sales Co. 30
L. B. Allen Co., Inc. 84
Alloy Rods Co. 60, 61
All-State Welding Alloys Co., Inc. 54
American Chain & Cable Co. Page Steel & Wire Div. 51
Ampco Metal, Inc. 12
Anaconda American Brass Co. ..... Back Cover
Ansco 67
Aronson Machine Co., Inc. 25
Atlas Welding Accessories Inc. 31

B

Bausch & Lomb Inc. 59
Bernard Welding Equipment Co. 5
Breitenstein Co., C. J. 32
Bridgeport Brass Co. 13
Brunmar Commercial Corp. 36

C

Chicago Mfg. & Dist. Co. 70
Contour Sales Corp. 74
Cosa Corp. 54

D

J. W. Dice Co. 68

F

Frommelt Industries 82

G

Galv-Weld Products 84
Glendale Optical Co. 32
Glenn Pacific Corp. 53
Goldsmith Brothers Div. of National Lead Co. 56

H

Hamilton Electrona, Inc. 11
Handy & Harman 65
Harnischfeger Corp. 14
Haynes Stellite Co. 55
Hobart Brothers Co. 1, 2

I

International Nickel Co., Inc. Huntington Alloy Products Div. 73
Invincible Vacuum Cleaner Mfg. Co. 34

J

Jackson Products ..... Inside Front Cover

K

Krembs & Co. .....

L

Lenco, Inc. .....
Lincoln Electric Co. 75
Linde Co. 28, 29,
Liquid Carbonic Div. .....

M

Manhattan Rubber Div. .....
Merrill Brothers .....
Miller Electric Mfg. Co. .....

N

National Welding Equipment Co. .....
Norton Co. .....

O

Oerlikon Machine Tool Works .....
Oxo Welding Equipment Co. ..

P

Page Steel & Wire Div. American Chain & Cable Co.
Picker X-Ray Corp. .....
Progressive Welder & Machine Co. .....

R

Rankin Mfg. Co. .....
Ruemelin Mfg. Co. .....

S

Singer Glove Mfg. Co. .....
A. O. Smith Corp. 12
Smith Welding Equipment Div. of Tescom Corp. .....
Speedy Pipe Beveler .....
Stulz-Sickles Co. .....
Sylvania Electric Products Inc. ..... Inside Back C

T

Tempil Corp. .....
Thermacote Co. .....
Thermico Corp. .....
John Tillman & Co. .....
Trindl Products Ltd. .....
Tuffaloy, Air Reduction Sales Co. .....

V

Victor Equipment Co. .....

W

Wallace Supplies Mfg. Co. ..6
Welding Engineer .....

E
no way
en taken
llowance
70
83
75-78
8, 29, 37
84
9
81
38
ment
63
6
27
Co. 82
ble Co. 51
4
80
50
69
84
17-24
nt
33
83
10
ts
Back Cover
82
64
57
68
70
35
40
Co. 68, 69
83

167. Glendale Optical Co., Inc. — Write for the 1961 catalog on welding goggles manufactured by Glendale.

178. Glenn Pacific Corp. — Literature and prices on the Glenn CV200 constant voltage welder for MIG welding is available.

189. Handy & Harman — Bulletin 20 available on Brazing Alloys manufactured by Handy & Harman.

151. Hobart Brothers Co. — Bulletin DM-101 further explains the Hobart motor generator welder.

169. Invincible Vacuum Cleaner Mfg. Co. — Send for Invincible Flux Recovery Equipment Folder.

205. Lenco, Inc. — Chart available showing symbols for arc, gas and resistance welding.

201. Merrill Brothers — Catalog C-3 available on "Large Opening "G" Clamp" and other material handling devices.

174. Miller Electric Mfg. Co. — Descriptive literature on the Miller Gold Star SR welder available also pamphlet "Rectifiers for Welding."

203. Oxo Welding Equipment Co. — Catalog available on all models of regulators manufactured by Oxo.

177. Page Steel & Wire Div. — Information on the complete line of Page welding wire are found in Folders DH-402 and and DH1218.

194. Ruemelin Mfg. Co. — Write for Bulletin 37-E describing the new spring-loaded counter-balance mechanism fume collector.

207. Singer Glove Mfg. Co. — Catalog available describing protective screens, welding gloves and safety clothing, manufactured by Singer.

206. Speedy Pipe Beveler — Brochure available on Speedy Pipe Beveler.

157. Stulz-Sickles Co. — Literature available on "Manganal" for worn heavy duty equipment parts.

170. Tuffaloy Dept. Air Reduction Sales Co. — Tuffaloy Catalog available on bent tips.

175. Victor Equipment Co. — Bulletin RV-2 further explains Victor regulators and Victrometers.

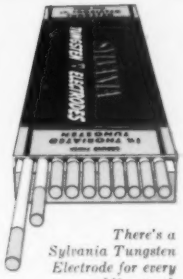
Illegible or incomplete addresses may keep you from receiving the information you desire. And remember, cards postmarked after the deadline date cannot be processed.

★Post card not valid after three (3) months. After that, write *directly to the manufacturer*, describing fully the information and/or literature wanted.

wins victory for mines over matter

TIG welding solved a major problem in producing new, lightweight mining hopper cars. And whether you're welding railroad cars, transcontinental pipelines, or nuclear steam-supply valves, Tungsten Inert Gas Welding gives you many outstanding benefits. For the finest there is in Tungsten Electrodes, look to Sylvania.

Sylvania offers the most complete line of top-quality Tungsten Electrodes: Puretung®, Zirtung®, 1% Thoriated, 2% Thoriated. Each comes in the preferred finish—cleaned or ground, and color-coded to save you time and prevent costly errors. Chemical & Metallurgical Division, Sylvania Electric Products Inc., Towanda, Pennsylvania.



There's a Sylvania Tungsten Electrode for every welding need.

SYLVANIA

Subsidiary of **GENERAL TELEPHONE & ELECTRONICS**

For more facts Circle No. 209 on Welding Info-Aid Card

for a wide range of processes

Anaconda Welding Rod is made in a range of alloys to meet the requirements of various welding processes. For example:

- Braze-welding of iron and steel castings and sheet steel.
- Arc-welding of copper and copper alloys, including Anaconda's own Everdur® copper-silicon alloy.
- Surfacing by both arc and oxyacetylene processes.

In most cases, Anaconda distributors can help you select the rod for the job. If you have a specific problem, Anaconda welding engineers are at your service. Call on them at any time for technical assistance.

And be sure to write for your copy of Publication B-13. Here you will find information on welding with Anaconda copper and copper alloys—with the newest procedures covered in detail.

Address: Anaconda American Brass Company, Waterbury 20, Conn. In Canada, Anaconda American Brass Ltd., New Toronto, Ontario.

61-816

SPOOLED WIRE FOR MIG WELDING
Anaconda spooled wire for MIG welding machines is now available in several alloys on convenient 25-pound spools. Write for details.

ANACONDA®
AMERICAN BRASS COMPANY

For more facts Circle No. 210 on Welding Info-Aid Card